FEB 1 1911

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second-class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the Act of Congress March 3, 1879

VOL. XXVI NO. 4 | SAN FRANCISCO, JANUARY 28, 1911 | PER COPY, 25 CENTS

Wagner Single-Phase Motors

THE WAGNER COMPANY WAS THE PIONEER in the development of the commercially successful motor of the single-phase type. For many years it was practically the sole manufacturer of this type and is today the recognized leader in the single-phase field.

For a given starting torque a Wagner Single-Phase motor disturbs one phase of a polyphase line, from which it takes its entire power, less than the ordinary polyphase motor disturbs every phase.

Polyphase generation with a single-phase distribution has become to be recognized as modern practice.

As alternating current single-phase and polyphase motor specialists, we invite correspondence.

Wagner Electric Manu'f'g Company ST. LOUIS MISSOURI

Wagner, Quality

SAN FRANCISCO, BALBOA BLDG.
SEATTLE, PACIFIC BLOCK
DENVER, GAS & ELECTRIC BLDG.

61-2056

FOR INDEX TO ADVERTISEMENTS SEE PAGE EIGHT

GREENFIELD FLEXIBLE STEEL CONDUIT

PALMER HOUSE, CHICAGO, ILL.
Wired with Greenfield Flexible Steel Conduit

APPEALS TO CONTRACTORS BECAUSE IT IS ECONOMICAL CONVENIENT AND EASY TO INSTALL

Ask us for Pamphlet No. 42954

SPRAGUE ELECTRIC COMPANY

General Offices: 527-531 West 34th Street, New York City

SAN FRANCISCO, Atlas Building — SEATTLE, Colman Building

The Pacific Gas and Electric Company

Supplies Light, Heat, and Power

TO

Place	Population.
Agua Caliente	50
*Alameda	27,000
**Albany	800
††Alta	200
Alvarado	200
Amador	200
Antioch	3,000
††Auburn	2,050
Barber	200
**Belmont	600
Belvedera	350
Benicia	2,500
**Berkeley	42,000
Big Oak Flat	150
Biggs	750
Black Diamond	500
Brentwood	200
Brighton	100
Broderick	500
‡Brown's Valley	50
**Burlingame	5,000
Byron	200
Campbell	1,000
Cement	1,500
†Centerville	20
Centerville	500
**Chico	13,000
**Colusa	2,700
†Colfax	400
Colma	500
Concord	1,500
Cordelia	150
Corte Madera	350
Crockett	2,500
Crow's Landing ...	375
Davenport	1,000
Davis	750
Decoto	350
Dixon	1,000
Dobbins	50
Drytown	100
Durham	500
†Dutch Flat	400
**Easton	500
**East San Jose	1,500
Eckley	20
Emerald	50
Elmhurst	2,500
Elmira	150
El Verano	100
**Emeryville	2,000
Encinal	20
Fairfield	800
**Fair Oaks	250
Fitchburg	250
Folsom	1,500
*Fresno	35,000
Glenn Ellen	500
Gold Run	100
Grafton	350
†Grass Valley	7,000
Gridley	1,800
Groveland	50
Hammonton	500
Hayward	4,000
Hollister	3,000
Ione	900
Irvington	1,000
Jackson	2,000
Jackson Gate	50
Larkspur	950
Lawrence	100
Kennedy Flat	50
Kentfield	200
†Lincoln	1,500
†Live Oak	200
Livermore	2,250
‡Loomis	150
Los Altos	200
Los Gatos	3,000
Mare Island	500
Martell	25
Martinez	5,000
**Marysville	6,250
Mayfield	1,500
**Menlo Park	1,500
Meridian	300
**Milbrae	300
Mill Valley	4,500
Mission San Jose ..	500
Mokelumne Hill ...	150
Mountain View ...	2,500
**Napa	6,000
†Nevada City	4,000
Newark	700
‡Newcastle	600
New Chicago	25
Newman	1,000
Niles	800
**Oakland	230,000
Oroville	2,500
Orwood	50
Pacheco	200
**Palo Alto	6,000
†Penryn	250
Perkins	200
**Petaluma	6,000
Peyton	250
**Piedmont	2,000
Pinole	1,500
Pleasanton	2,000
Port Costa	600
**Redwood City	3,500
Richmond	10,000
Rio Vista	200
‡Rocklin	1,050
Rodeo	100
†Roseville	345
Ross	900
***Sacramento	52,000
San Andreas	200
San Anselmo	2,500
San Bruno	1,500
San Carlos	100
**San Francisco ...	450,000
**San Jose	40,000
San Leandro	4,000
San Lorenzo	100
**San Mateo	7,000
San Pablo	1,000
**San Quentin Prison	1,600
**San Rafael	6,000
Santa Clara	8,000
Santa Cruz	10,000
**Santa Rosa	8,000
Saratoga	200
Sausalito	3,000
Sebastopol	2,000
Selby	100
Sonoma	1,200
South San Fran....	2,500
Stanford University	2,000
Stege	100
‡Stockton	25,000
Suisun	1,200
Sunnyvale	2,000
Sutter Creek	2,000
Tiburon	100
Tormey	150
‡Towle	200
Tracy	1,200
Vacaville	2,500
**Vallejo	12,000
Vallejo Junction ..	10
Walnut Creek	350
Wheatland	1,400
Winters	1,200
**Woodland	3,500
Yolo	350
**Yuba City	1,900

*Gas only: **gas and electricity: †electricity, gas, and water: ‡electricity and water: ***gas, electricity, and street car service: all others, electricity only.

Service Furnished	Number of Towns	Total Population
Electricity	158	1,089,790
Gas	33	988,900
Water	17	43,415
Street Car	1	52,000

EMPLOYS 3,500 people

OPERATES 11 hydro-electric plants in the mountains

3 steam-driven electric plants in big cities.

18 gas works

SERVES ⅔ of California's population

26 of California's 56 counties

An area of 32,431 square miles

3/5 the size of New York state

½ the size of all the New England states combined

B 736036

JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXVI | SAN FRANCISCO, JANUARY 28, 1911 | NUMBER 4

[Copyright 1911, by Technical Publishing Company]

HISTORY OF NAPA AND ITS GAS BUSINESS

By E. C. JONES.[1]

E. C. Jones

Napa, nestling in her inland valley, at the head of navigation on the Napa River, forty-six miles from San Francisco, is one of the most beautiful residence towns of California. It is a community of 7500 people, and the seat of Napa County, which embraces a territory of eight hundred square miles.

Here is a city of homes surrounded by lawns and flowers; possessing all the charm of New England's country towns, with their beautiful shade trees, combined with California's delightful climate and all its gifts.

There are no waste lands about Napa. The town merges insensibly into orchards and farms and a beautiful and prosperous country side. Napa derived its name from the Indian word Nappo, used by the Pomo tribe to convey the idea of numbers—a collection, a group of dwellings. The valley was originally occupied by the Pomo Indians, whose descendants, still famous among aboriginal basket-makers, are now found in Lake County and some other northern district of California. The path of these Indians, as they retreated further and further northward before the white settlers, is marked along the way by names that are traceable exclusively to the vocabulary of the Pomo tribe.

A Characteristic Landscape Near Napa—Vineyards, Orchards, Wooded Foothills and Surrounding Mountains

Pomo legends of the old days when the tribe dwelt in the Napa Valley mention the large quantities of fish in the waters there, and particularly the hordes of salmon that annually ascended the Napa River. This abundant supply of their favorite article of food caused the Pomo Indians to congregate about the present site of Napa in a fishing village or settlement, or Nappo.

In 1829 Kit Carson, the famous hunter, visited California on a hunting expedition. In describing the Indian population he said that many of the interior tribes were continually at war, while those living near the coast were comparatively orderly and peaceful. The indolence and indifference of the coast Indians he ascribed to the mildness of the climate and the ease with which they could obtain a living.

In 1830 there were about 3000 Indians within the boundaries of what is now Napa County. The first grant by the Mexican government of land in what is now known as Napa County was made to George C. Yount, who was the first white man to settle in the valley. His grant comprised two square leagues situated in the heart of the valley east of the present site of Yountville, and was given to him by Nicholas Gutierrez, March 23, 1836. After the American occupation of California it was confirmed to him by the United States Board of Land Commissioners February 8th, 1853, and by the United States Court in 1855.

[1] Chief Engineer Gas Department, Pacific Gas & Electric Company.

The Entre Napa Rancho, where the city of Napa now stands, was ceded to Nicolas Higuerra by Manuel Chico May 9th, 1836. This grant and Yount's were the beginning of white settlements in Napa Valley.

George C. Yount was an American and arrived in California in February of 1831. He was accompanied by a young man named Guy F. Flynn, who acted as guide and afterward became a settler in the county. It seems to be a fact that Flynn visited the Napa Valley as early as 1825, and obtained the knowledge of the country that enabled him to act as a guide to Yount. Flynn revisited the valley, located there permanently, and in 1872 he died in a little old house among the Indians near Napa.

Yount did hunting and trapping until 1836, when he built the first log house erected in California by an American. It was eighteen feet square, with an upper story twenty-two feet square in which were portholes for the purpose of defending himself against the Indians. After obtaining from the Mexican government his grant of land, which was known as the Caymus Rancho, he became a permanent resident of the valley, remaining until his death, October 5th, 1865.

Among the early settlers who followed Yount was Nicolas Higuerra, who settled on the banks of Napa Creek. There he built a wicker house, plastered with mud on the outside and covered with a thatch of tule reeds. Two of Higuerra's daughters afterward married into the Berryessa family of the valley in Napa County which bears that family's name.

Bartlett Vines had come across the plains with Yount, and in 1844 he went to Napa on board Captain Sutter's schooner "Sacramento." He was Yount's son-in-law. To the Vines family came the first white child born in Napa County, and, it is claimed, the first American child born in California.

As early as 1841 John Rose and John C. Vines built a schooner at Napa and launched it at a point just above the present stone bridge on First street. It was not much larger than a whale boat. In 1849 they built a barge which was used as a trading boat in all the bay inlets.

One of the curiosities of the olden days in Napa was the first carriage, the property of General Vallejo. It had been at one time the state carriage of the Duke of Wellington. General Vallejo purchased it in London in 1833, and brought it to California shortly afterward. The driver of the carriage rode on one of the horses.

The first Board of Supervisors of Napa County convened December 7th, 1856.

The fertility of the land and the splendid climate of the valley tempted the early settlers to experiment with semi-tropical plants.

In 1861 William Baldridge tried to raise cotton in the Napa Valley, but with no success. His experiments proved that the soil was much better adapted to the growing of grapes than to cotton. To Baldridge belongs the credit of planting, from seed sent him in 1845, the black locust trees that are seen along the coast highways of California.

In 1864 a crop of tobacco was planted near Napa by George N. Cornwall and John Cornwall, with much success.

The first railroad into Napa was completed from Soscol January 10th, 1865. The rolling stock consisted of two cars and a pony engine. The track entered Napa by the way of Main street, and was laid along that street to Third street. The first train passed over the track the 11th of July, 1865.

The original boundaries of Napa County also included all of the territory now known as Lake County until 1861, when Lake County was created.

The first mention of Napa in any newspaper was in an article in the "Californian" in 1848, which stated that the ship "Malek Adhel" had passed up the Napa River and "found plenty of water to a point below the Embarcadero de Napa."

Early in May in 1848 the first building in the town was erected. This, probably by the merest accident, happened to be a saloon eighteen feet by twenty-four feet in dimensions. The historian tells us that the saloon formed a nucleus about which the present city has grown. The lumber for this building was sawed at Bale and Kiburn's mill, two miles above St. Helena.

The site of the town of Napa was surveyed and laid out in the spring of 1848 by Nathan Coombs. The original limits of the town included only the land lying between Brown street and the river and extended six hundred yards from Napa Creek to the steamboat landing. The town was originally divided into upper and lower sections, Napa Alta and Napa Abajo. The Alta section, consisting of more than one hundred acres, was known as Thompson's Addition. The Embarcadero, or landing, was at the head of navigation, and the ford just above it determined the location of the town. That was before the erection of the beautiful bridges, which have added so much to the attractiveness of the Napa Valley.

During the year 1848 John Truebody mowed almost the entire town-site, which was covered with a rank growth of wild oats. He sold the hay to the government. The discovery of gold in that year almost depopulated Napa, as it did other towns in California.

The first bridge across Napa Creek was built in 1849, near the line of Brown street. It was a timber bridge, and the two wooden stringers, each sixty feet long, cost $100 each, which gives an idea of the high price of materials at that time.

Very little United States coin was in circulation then, and even as late as 1856 the medium of exchange was gold dust, foreign coin, or a substitute for coin issued by the assay office of Kellogg and Humbert in San Francisco. These were gold pieces of $5, $10, $20 and $50, were of weight and fineness equal to the United States government standard, and were readily accepted as legal tender. No change was used smaller then a "bit," having a value of twelve and one-half cents. The price of everything, including labor and all classes of material, was enormous. Money was the only thing that was plentiful.

In 1854 the town of Napa had a population of about four hundred, and there were in all about forty buildings. As late as 1856 very little effort had been made to improve the streets or the highways, and both were almost impassable during the rainy season. There were only two places on Main street where a person on foot could cross. Crossings were made

with bundles of straw thrown into the mud until the bottom was found. This is in sharp contrast with the excellent roads for which this county is now noted, some of the best automobile drives in California being in Napa County. All the roads are sprinkled in the summer-time.

It is said of the first newspaper published in Napa, the 4th day of July, 1856, and known as the "Reporter," and it was a "tri-weekly"; that is, they published it one week and tried for another week to get it out again.

Napa was the tenth city in California to introduce gas for illumination. In 1867 William Smith and E. E. Chalmers were granted a franchise but did not operate under it. They conveyed their rights to James H. Goodman, James Freeborn, and William W. Beggs, who incorporated "The Napa City Gas Light Company" with a capital stock of $80,000, May 25th, 1867. Beggs was at that time the chief engineer of the San Francisco Gas Company. The gas works was located on a lot sixty feet by one hundred and twenty feet on Fifth street, between Main and Brown streets. The brick building was a counterpart, as to size and general design, of the Oakland gas works of that time, also designed by Beggs. The office, condensing and purifying room, and retort house were all under one roof.

Napa County Is Noted for Its Stone Bridges.

A Picturesque Old Mill, Near St. Helena, Napa County.

A 7000 cubic foot gas holder was constructed in a redwood tank, and there were two benches of iron retorts, one retort in each bench capable of carbonizing 2000 pounds of coal at a charge. Oak wood and the coke made from the coal were used to heat the benches. The coal used for making gas was Scotch and Australian cannels, costing from $20 to $30 a ton. It was freighted by schooner from San Francisco at a cost of $2.50 a ton, with $1 drayage added. At that time all coal sold in San Francisco for reshipment had to be sacked, and the cost of gunny bags, filled and sewed, was added to the expense of the coal. The yield of gas the pound from this coal was four to four and one-half cubic feet.

The condenser was of the ordinary return tubular type, made of tin, as was also the centre seal of the purifiers. They were furnished by Morris Dobrzensky, who was the first manufacturer of gas meters on the Pacific Coast. There were two redwood purifying boxes four feet by five feet by three feet, with wooden trays. Dry lime, costing $2.25 a barrel, was used as a purifying material.

All the pipe at the works beyond the condenser was of galvanized sheet iron, with soldered joints, and it was made and erected by Napa tinsmiths.

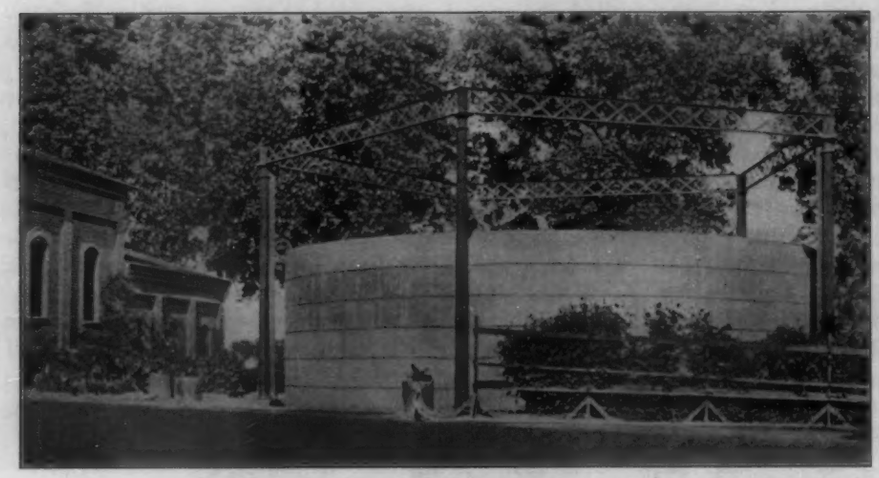
Gas was first turned on in Napa and the town lighted September 1st, 1867. Henry Adams, formerly with the gas company at Sacramento, and later superintendent of the gas works at Oakland, was the first superintendent at Napa.

The original price of gas was $7.50 a thousand cubic feet, and there were sixty-five consumers. The county paid for thirty-three street lights at the rate of $9 a month. These street lights were used only when there was no moonlight.

The first street mains laid in Napa were mostly condemned boiler tubes two and one-half inches in diameter, in six-foot lengths, and joined together by cast-iron sleeves with lead joints.

In April of 1869 Adams resigned as superintendent to accept a similar position at the gas works in Stockton, and he was succeeded at Napa by T. R. Parker. At that time James H. Goodman, James Freeborn, and Captain Harry Parker were the directors of the Napa Gas Company, and Richard Dudding was secretary.

During that year, 1869, prosperity, long held back by the civil war, returned, and Napa felt its good



The Old Gas Plant at Napa, Built in 1888.

The Water Tower in Napa.

effects. The income tax was abolished, and even the gas business in Napa shared in the good times. The price of gas was reduced to $6 a thousand.

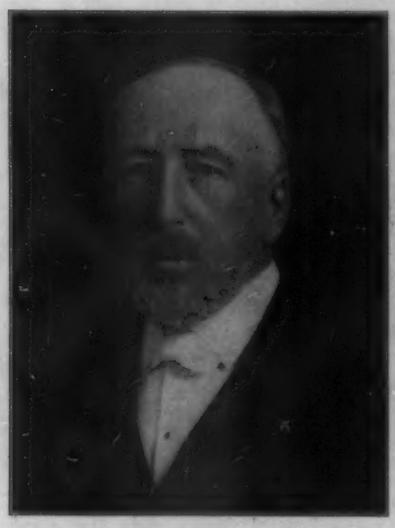
Under T. R. Parker's efficient management many improvements in the making of coal gas were introduced, including large clay retorts, each capable of carbonizing three hundred to four hundred pounds of coal. The purifying house was remodeled, and the street-main system was thoroughly renovated and enlarged. The rates on street gas-lamps were also reduced to $6 a month each.

It was about that time that bituminous coals for gas-making were brought from Vancouver and Australia to take the place of the more expensive cannel coals which had previously been used.

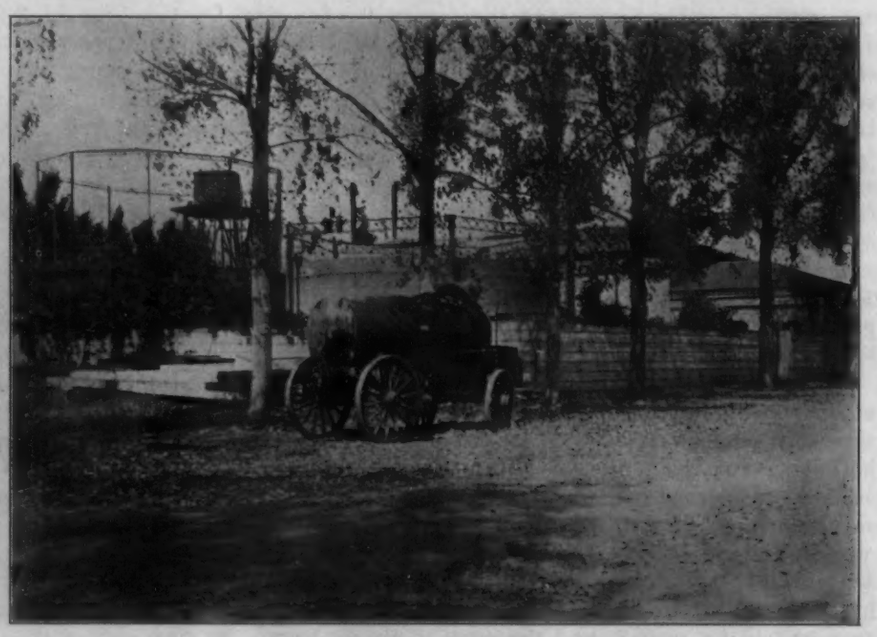
These cheaper coals were Nanaimo from Vancouver and Greta and Wallsend from Australia. The gas made from them was enriched with Anvil Creek cannel, or shale, from Australia. Coke in those days sold at $20 a ton, and tar at 10 cents a gallon.

These improvements increased the earning capacity of the company so that dividends were declared at the rate of 15 per cent on the actual investment. Also the company voluntarily reduced the price of gas to $5 a thousand, and the rate on the ninety street lamps to $4.50 each a month.

The 13th of August in 1888 the directors of the company decided to erect a new gas works. John Fullagar, formerly superintendent of the gas works at Cincinnati, Ohio, was employed to construct it. The company was disincorporated, and then re-incorporated under the name of the Napa Gas Light & Heating Company. The articles of incorporation were dated November 20th, 1888. The first board of directors of this new company consisted of George E. Goodman, Theodore R. Parker, E. S. Churchill, Isabella Parker and James Freeborn. H. P. Goodman was secretary, and John Fullagar was superintendent. The new gas works was erected on the site of the present works and included a 20,000 cubic foot gas holder and a complete six-inch coal-gas works, with Hicks settings of clay retorts. The price of gas was again reduced, and made $4 a thousand, and the street-lamp rate was reduced to $3.50 for every night and all-night service.



T. R. Parker.



The Gas Works at Napa.

In 1889 Fullagar resigned the superintendency to take charge of the gas works at San Jose. This brings the Napa gas works down to the time the writer took up his residence in California.

Coming in 1889 from the east, where the highest types of coal-gas benches were in use and where there was a rivalry among different plants to obtain the best results, it was a pleasurable shock to me, upon visiting the little coal-gas works in Napa under the able management of T. R. Parker, to find the retort house equipped with the most modern type of full-depth regenerative benches, containing five retorts, each capable of carbonizing a ton of coal in five hours, and giving an average yield of 11,000 cubic feet for each ton of coal. Such results were better than were then obtained in some of the best eastern gas works. In looking about for the reason for such results I found it in the skill and ingenuity of T. R. Parker. He had applied his own improvements to the best knowledge then obtaining in the east, and his gas plant there at Napa surpassed in results attained all the other coal-gas works in California. Coupled with mechanical excellence was the highest degree of cleanliness possible in a gas works. About the buildings the grounds were laid out in gardens of roses and cannas, and round the gas holder tank were beds of calla lillies, while at the back of the garden were trellises completely embowered with purple wistaria. Everywhere, inside and outside the works, was evident the touch of Parker's knowledge and good taste.

In 1893, at the organization of the Pacific Coast Gas Association, T. R. Parker was one of the charter members. To his enthusiastic good work much of the first and continued success of the association is due. He immediately took charge of the "Wrinkle Department," and the splendid results of his conscientious work are a matter of record in the proceedings of the association. In 1897 T. R. Parker was elected president of the Pacific Gas Association, and he performed the duties of the office with credit to himself and profit to the organization.

Then came electricity as a rival of gas. In November of 1899 Dr. Thomas Addison, coast manager of the General Electric Company, and John L. Howard purchased the old steam electric plant in Napa from the General Electric Company and the Napa gas works from the George E. Goodman bank people.

O. E. Clark was then appointed manager of the combined enterprises, with T. R. Parker as superintendent of the gas works.

During all those years T. R. Parker had also managed the interests of the Napa City Water Company, as its superintendent. When the city was small he was able to attend to both the water and gas works, but with the growth of Napa and the consequent increase in the use of water he decided to devote his attention entirely to the interests of the Napa City Water Company. One of the accompanying illustrations shows the water tower at Napa, which he designed. It stands as a sort of landmark, and as a reminder of what the long influence of T. R. Parker has meant to that city beautiful.

At the time of the consolidation in 1899 George E. Goodman, who had been associated with the Napa gas interests from the beginning, severed his connection with the business.

An illustration accompanying this article shows the beautiful library that building George E. Goodman presented to Napa, with the proviso that it should always be used "as a library and a resting place for the country people during their trips to town."

Public Library—Presented to Napa by George E. Goodman, Formerly President of the Gas Company.

The Napa gas works was operated by the new owners until the winter of 1902. Then the company was purchased by the California Central Gas & Electric Company, and O. E. Clark was retained as manager of the new concern. Since then the Napa Gas Light & Heating Company has become one of the subsidiary companies of the Pacific Gas & Electric Company.

As fuel oil became plentiful in California, and the new method of making gas from petroleum was rapidly superseding the use of coal, the gas works at Napa was equipped with a complete oil-water-gas plant, with a capacity of 5000 cubic feet an hour. A 20,000 cubic foot relief holder was added to the plant, as well as a 500 barrel tank for the storage of oil. At the time the works was taken over by the California Gas & Electric Corporation the daily output of gas was from 12,000 to 15,000 cubic feet. At the present time, in 1910, the output is 45,000 cubic feet a day. During the period since the introduction of fuel oil the distributing system of pipes has increased from six and one-half miles to twelve and one-quarter, or nearly double.

PETROLEUM PRODUCTION.

According to the figures of Dr. David T. Day, Geological Survey statistician and oil expert, the production of oil in the United States in 1910 was between 204,000,000 and 208,000,000 bbls. of 42 gals. each.

The estimated oil production in 1910 in this country is as follows—in bbls. of 42 gals. each:

Field.	1910.	1909.
California	77,000,000	54,433,010
Illinois	34,450,000	30,898,339
Appalachian and Lima-Indiana fields	53,000,000	34,747,287
Gulf and Caddo, La.	14,000,000	11,912,058
Midcontinent and Rocky Mts. fields	53,000,000	50,243,608
Totals	210,450,000	182,134,274

WATER LAWS OF WASHINGTON.

BY JOHN C. STEVENS.

The following is a summary of present Washington statute law relating to water rights, published in Water Supply Paper 253 of the U. S. Geological Survey and abridged from a summary of irrigation law prepared by Ralph B. Williamson, attorney, United States Reclamation Service:

Appropriation and Acquiring of the Right.

The right to use the waters of the State may be acquired by appropriation, the first in time being the first in right. Written notice must be posted near the point of intended storage or diversion, stating the amount, purpose, places of use and means of diversion or storage, and such notice must be filed with the county auditor of the county where the notice is posted for record within ten days. All amounts must be multiples or fractions of a cubic foot per second of time.

Construction of works.—An appropriator must begin construction of works within three months after posting of notice if use is by storage; if by diversion within six months, and must diligently prosecute them to completion, compliance with which gives priority as of time notice was posted. It would seem that actual construction of a ditch gives right to unappropriated waters at the time construction is begun for irrigation and pumps may be used when the land cannot be reached by gravity flow. Head-gates of existing canals may be changed or extended on streams where naturally made necessary, subject to existing rights.

Filing of maps.—Within ninety days after construction or enlargement of a canal, there must be filed with the county clerk of the county in which the head-gate is located, a map showing location of head-gate, route of ditch, legal subdivisions crossed and names of owners, with statement showing locatior of works, depth, width, and grade of ditch, its carrying capacity and time of commencement of the work. Such filing will give priority from date of commencement of the work; if after ninety days, only from date of filing of the map.

Seepage and springs.—Water from seepage and springs is governed by the general laws, provided that a man on whose land such waters first appear has prior right thereto; and a man whose lands have been thus irrigated by seepage, has priority as of time of use of seepage, if by natural cause he must construct ditch to source of seepage to irrigate the lands. The same rule applies to artesian wells.

Change of use.—The purpose of appropriation may be changed to any beneficial use without losing the priority of the original appropriation.

Transfer.—The right to the use of water is not made appurtenant to land but is allowed to be transferred, like property, by deed.

Surplus waters.—Riparian owners of lands on any stream are given the right to use any surplus or unappropriated waters. The same privilege is granted to non-riparian owner.

Loss of rights.—It is provided that failure to comply with the requirements of the statutes deprives the appropriator of his priority against a subsequent appropriator. Lack of diligence in construction forfeits rights.

Right of Way.

State lands.—Right of way across State lands is given to irrigation districts for all irrigation work.

Private lands.—A right of way for ditches sufficient for the purpose required is given to all persons, corporations, etc., who may have a right to use water and may be acquired by condemnation. Such right of way must be the shortest possible route across such land and no land owner will be burdened with more than one ditch, if one will serve the purpose.

Natural streams.—Any person may take water which he has acquired the right to use along any of the streams or lakes of the State, not raising the water above high-water mark.

Eminent Domain.

Public use.—The use of the waters of the State is deemed a public use and the right of condemnation is given to all persons having a right to use it, for purposes of acquiring rights of way. Procedure is provided in Laws of 1899, page 262.

Riparian rights.—Riparian rights in any natural stream or lake may be condemned but this applies to riparian rights and cannot be applied to take water from the person himself using it for irrigation. Procedure is prescribed.

Duties of Ditch Owners.

Head-gates, embankments, repairs.—Every ditch owner, owner being the person having charge and control and liable as owner, must erect and keep in good repair a sufficient head-gate at the head of his ditch to control the ordinary flow therein. He must keep embankments and all flumes or other conduits in good repair so as not to injure the premise of others. He is made liable for damages resulting through refusal or neglect to comply with these provisions.

Waste.—Drain ditch shall be provided to return water to stream with as little waste as possible.

Unnecessary diversion.—It is unlawful for any person to run a greater quantity of water through his ditch than is absolutely necessary for irrigation of lands watered and for domestic and stock purposes. A violation of this provision is a misdemeanor punishable by a fine not exceeding $1000.

Determination of Rights.

Basis of determination.—Whenever called into question in any court or before any commissioners (infra) the determination shall be based upon the used volume of water annually flowing in the stream or lake, and in the event of unusually low water, all rights shall be proportionately reduced.

Hearing and adjudication of priorities.—When the owner of any canal in any water district (infra) shall present a written petition to the superior court praying the court to adjudicate priorities between the several canals in the district, the court shall, if deemed practical to proceed, appoint a day to commence to hear and take evidence in such adjudication. All interested parties may offer evidence. The court shall ascertain the date of commencement of the ditch, its original

size and capacity, or the time of enlargement and increased capacity, the diligence of construction, and all facts tending to show compliance with the law. He shall determine on the evidence, the priority of appropriation with amounts which each has perfected thereunder, expressed, if possible, in second-feet; if not, by width, depth, and grade of canal.

Certificate.—The clerk shall issue, upon reasonable fee, to each party interested, a certificate, showing dates and amounts of appropriation adjudicated and specifying number of the ditch and of the priority.

Procedure.—Notice of time for adjudication shall be published once a week for four successive weeks; notice containing a copy of said order shall be posted in ten public places in water districts, and proof of such publication and posting shall be made. Service of notice is also provided for.

Decree.—The court in its decree shall number the ditches in the district in the order of priority, and also number appropriations consecutively, beginning with the oldest. Both shall be incorporated in said certificate of the clerk, issued to claimant.

Distribution of Water.

Water districts.—Each county in the State shall be constituted an irrigation district.

Water commissioners.—A commissioner for each district may be appointed by the county commissioners in each county, at a salary fixed by them, provided that if 12 freeholders, irrigating lands, shall petition therefor the county commissioners must appoint such commissioner.

Such commissioner shall take oath of office and give a bond as may be required by the county commissioners, for the faithful performance of duties, and shall be entitled to compensation at $4 per day, actual employment.

The commissioner may, in emergency cases, employ one or more assistants, who take the same oath and shall receive $3 per day.

Duties of commissioner.—Commissioners must divide the water in natural streams among the ditches taking water therefrom, and in times of scarcity must shut down and fasten head-gates of ditches not entitled to water.

Register of priorities.—A register of priorities must be kept by commissioner when such priorities shall have been determined by commissioner from decrees or other legal source. He must keep record of certificates of courts (supra), with contracts of same.

Court Commissioners.

Where insufficient water.—When volume of water in any stream is insufficient, upon application of any party interested, the superior court shall appoint three commissioners to go upon such stream and apportion water, as they may deem equitable. Such apportionment shall be for domestic purposes before any is given for irrigation.

To determine proper diversion.—In the same way the court shall appoint three commissioners to inquire and determine whether or not more water is being diverted than is properly used. Their decision is final. They may order the ditch owner to turn back unnecessary water. Failure to comply with the order is punishable as contempt of court.

Rotation of water.—In case of insufficient water in a stream to supply the wants of the entire country through which it passes, the superior court shall appoint three commissioners to apportion in equitable manner a certain amount of water upon alternate days in certain localities with due regard to legal rights of all.

Individual ditches.—When any ditch shall not be entitled to a full supply of water, the amount actually diverted shall be prorated among shareholders and users of water in such ditch.

Miscellaneous Provisions.

Interference with appliances.—Every person interfering in any way with head-gates or measuring boxes without authority shall be guilty of a misdemeanor and subject to a fine of not less than $25 or more than $100, or maximum imprisonment of six months or both.

Injury to ditches.—Any person breaking or injuring the embankment or head-gates of any ditch with malicious intent, or for private gain to injury of persons lawfully using said ditch, shall be guilty of a misdemeanor, punishable by the maximum fine of $500 or maximum imprisonment of six months, or both.

Corporations deemed common carriers.—Any corporation organized in the State therefor may construct ditches for irrigation, and may condemn rights of way therefor, whether or not said corporation owns lands upon the line of such ditch. Such corporation is deemed a public carrier, and is subject to legislative rules and regulations relating thereto.

Federal Government.—Authority is given to the United States to avail itself of the provisions of the law. Upon authoritative notice to the land commissioner that the Government contemplates the construction of irrigation works, all waters specified will be withdrawn from appropriation under foregoing laws for a period of one year, which withdrawal may be extended three years by certificate from duly authorized agent within the said year that work undertaken appears feasible and further investigation is intended to be made; and upon the letting of contract for construction work the United States may appropriate all unappropriated waters in the manner provided for private persons, the title to beds and shores of state lakes thus utilized passing to the United States upon such appropriation.

OBJECTIONABLE FEATURES OF PUBLIC SERVICE COMMISSION LAWS.

There is great likelihood that Public Service Commissions will be established in several of the Western States during the coming year. Results obtained in a number of Eastern States have pointed out certain principles to be adopted and certain principles to be avoided. A number of objectionable features of the New York code are here summarized:

More vital even than the provisions of such a law would be the personnel of the members of the commission. The day has passed when public service corporations can expect any special favors, and they are

more than satisfied if the treatment they receive is as fair as that extended to the ordinary citizen and taxpayer. The business of managing and controlling a public service corporation is one which requires not only a very considerable ability, but also a vast amount of intelligent study. Primarily then the members of such a commission should be able men who understand the management of public service corporations and who are able to devote all their time and attention to their duties. The commissioners under the New York act receive a salary of $15,000 and in order to insure the class of men which the duties demand it would be necessary that any commissioner appointed in the Western States should receive a salary of at least $10,000 a year. If public service corporations have to be regulated it should be by men of intelligence and ability whose salary places them beyond temptation, and the dignity of their position beyond the danger of being swayed by popular prejudice and passion.

Such a commission should be vested with the absolute veto power in the matter of all franchises granted by municipalities. This idea is not fostered by the feeling that existing companies desire to keep out competition but from the fact that experience has shown that where the territory will not support two companies one is invariably absorbed by the other, with the result that the public is compelled to pay interest upon a double investment covering the same territory. Careful inquiry should be made by the commissioners as to the financial backing of companies seeking to enter a field already supplied. It should also study carefully the ability of the community to support two companies together with the quality of the service furnished, and the fairness of the prices charged by the existing company.

There are in the New York act many clauses general in their nature and vicious in their possible application which in themselves add nothing to the force of a bill but would give to a radical commission almost unlimited power, such as Paragraphs 5, 8, and 9 of the New York Act.

Under the system of taxation which now probably prevails in several of these States and which is possibly as fair a method as can be found, the net earnings of public service corporations are limited to a certain income upon the investment in the shape of dividends. In other words, when the net income of a public service corporation exceeds a certain per cent of its capitalization the State will claim the balance for taxes and in order that the net income may be as large as possible, so that the taxes may be increased, an attempt will be made to jealously guard what a commission might term exorbitant salaries to officers and employees. For this and for the added reason, that the corporation in the management of its own business should be the sole and exclusive judge of the compensation to be paid its employees and officers, the fifth condition of Paragraph 6 of the New York code seems pernicious.

Section 67 of the New York code provides for the inspection and testing of meters; that portion of this section which provides for an inspection of meters at the expense of the corporation prior to their installation puts an unnecessary expense upon the company and the consumer is certainly amply protected by the succeeding section which gives him the right to have the meters tested after they have been installed and compels the company to pay the cost of such test, provided the meter is found to run fast, permitting a variation of 4 per cent.

Section 69 of the New York code, if literally construed, practically gives to the commission the right to arbitrarily refuse to permit the issuance of bonds by public service corporations for the purpose of making desired extensions and improvements or to pay indebtedness already incurred. Surely if the corporation is to be taxed upon all the property it possesses, including its franchises, if the quality of its product and the price charged is to be regulated and fixed by the commission, then at least the corporation should be permitted to manage its own affairs to the extent of making additions, alterations and extensions which are of such acknowledged beneficial nature that it is able to borrow the money in the open market to effect them.

Insofar as the constitution of the various Western States will permit any such act should give to the commission the same power to regulate and control the municipal plant as it is given to control the public service corporations, the same return which is requifed from the public service corporation regarding the salary paid to its officers and employees, the rates charged to its customers, its bonded indebtedness and its gross and net earnings, should be furnished by the municipal plant in order that the people who are forced to pledge their property for the support of such a plant may for the first time be able to learn the truth regarding its operation. In many cities a systematic effort has been made by the officials of municipal plants to conceal from the public the true facts concerning the maintenance and operation charges and the profits or loss resulting from such operation. Bonds have been issued under the pretense of making necessary extensions, the proceeds of which have been used to make up deficits which have occurred from loss in operation, and any public service commission should be vested with the right to bring the true condition of such plants to the knowledge of the people who support them.

Section 70 of the New York code gives to the commission the power to arbitrarily refuse permission to any gas or electric corporation to sell or lease its franchise or any portion of its property, or to contract for the operation of its system, and also prohibits the holding of stocks or bonds of any other corporation engaged in a similar business. This section reverts again to the question of the management of the company itself, which should not be given to the commission, but should be retained by the individuals who have invested their capital therein, and again we repeat that so long as the commission is gven the right to fix the quality of the output and the price to be charged and to regulate the method in which the service shall be made it should not be permitted to interfere in the management and operation of the plant itself.

Insofar as such a bill seeks to regulate the manner of service, the quality of the output and the rate charged we do not believe that the companies would be injured, and especially is this true if men of ability who will give the subject study are appointed

CORONA[1]

BY HARRIS J. RYAN.

The fundamental purpose of this paper is to discuss the high tension transmission corona problem in the light of the evidence available at the date of its preparation. As ionization plays an important part in all phenomena that lead to the formation of corona it is first requisite to have a thorough knowledge of the origin, inherent qualities and characteristic behavior of ions, i. e. of the electricity carriers in gases.

Every material substance is made up of atoms or their elemental aggregations, molecules. Each kind of substance has certain distinctive characterisics because of some structural character of its atoms. All kinds of atoms have one feature in common. Each atom holds through electrostatic attraction a certain number of relatively minute particles. The number of these particles is different for different atoms. Each particle is the seat of a certain definite electric charge. The amount of this charge is 4.65×10^{-10} electrostatic units—perhaps a little larger, not exceeding 5×10^{-10} electrostatic units. In the literature of the subject this ultimate particle of matter is burdened with two names electron, the one apparently in more general use, and corpuscle, the original term used consistently by some of the best known physicists. The frame of the atom is the whole of the atomic structure less the electrons and their non-detachable electrostatic fields.

A positive ion is formed when any neutral atom, molecule or atomic aggregation has, through any cause lost one or more electrons—usually but one. It thus becomes a positively charged ion. If the gas in which it is located is pervaded by an electric field it will be subjected to a corresponding force that will cause it to migrate in the general direction of the cathode or negative terminus of the field. The smallest positive ion is, therefore, a single atom that has one less than its normal quota of electrons. The largest may be any aggregation of atoms or molecules held together by the electrostatic field due to the loss from the normal stock of the aggregation of one or at the most a very few electrons.

A negative ion is any free electron, or any atom or unit atomic aggregation that has captured electrodynamically one, or at the most, a very few electrons more than the supply that constitutes the neutral atomic state. The smallest negative ion is a single electron—vastly smaller, therefore, than the smallest positive ion. The smallest positive and negative ions are alike, therefore, in the charges they carry and forces with which they are drawn through a common electric field. In sizes and masses of the smallest ions, the positive is, therefore, far greater than the negative ion. It follows that the mechanical activity of the smallest negative ion is far greater than that of the smallest positive ion.

In the open air, the natural ions present are in a comparatively quiescent state. By their electrostatic forces they have captured various molecular aggregations, generally made up mostly, though not necessarily, of water. These captured aggregations are retained while the dynamic activity of the ions is low. When, however, this activity is increased, by the presence of a sufficient electric field, such as is comparable with the fields set up about high tension circuits, the forces that have captured and retained the aggregations are no longer sufficient to hold them and they are lost. Thus it occurs that all ions that take direct part in the corona formation or in the essential phenomena that precede the corona state are only those of smallest size, viz., the electron and the neutral atom less an electron. This is so because all such phenomena are brought about by ions in a high state of electrodynamic activity.

The sources of ionization about high voltage transmission lines are:

Radioactivity that is entirely natural in the open air,

Impact of ions at the surfaces of conductors caused by the electric field, and

Collision of ions and atoms when the field exceeds the critical ionizing strength.

Every conductor exposed in the open collects upon its surface some radioactive emanations—the real essence of the "dirt" that causes the cathode conductor to start part-corona at abnormally low voltages. These emanations carry positive charges. The result is that the earth whence they escaped must carry a negative charge. Such a state gives rise necessarily to a positive charge of the atmosphere relative to the earth, the difference of potential depending upon the number of excess positive ions present and varying largely with altitude and topography. The electric field, and therefore radioactive emanations, is smallest in the canyons and highest on the peaks.

Without the prior existence of these natural ions in the air corona would not be formed except at extraordinary stresses. Whenever an ion, under the influence of an electric field, collides with an atom they "ionize by collision," i. e. each electron that strikes an atom of air in a stress above 76 kilovolts per inch does so at sufficient velocity to detach from such atom an electron. Two new ions are thus formed: the negative electron, and the neutral atom which lost it, and which was thereby given a corresponding positive charge and became a positive ion. The negative ion collides with the next atom and thus the ionization process builds up rapidly by geometric progression. Ionization by collision is always accompanied by luminousity, and is the cause of visible corona, part corona, brush discharge, sparks and ultimately arcs. Corona for all cases is simply a spark discharge phenomenon wherein the conductor is one electrode and the air conducting by diffusion is the other.

Under practical conditions, therefore, no corona will form on electrodes of either sign without a natural source of ionization and none will be formed at the negative electrode without some form of negative ionization at its surface or very near thereto. The known sources of negative ions at the surface of the cathode conductor are impact of positive incoming ions, radioactive emanations (dirt captured by the cathode and near the surface) and collision with neutral ions. Of these three impact is of predominating influence.

Each conductor is enclosed by a zone or envelope

[1] Abstract of paper submitted to the American Institute of Electrical Engineers through the San Francisco Section for the January 13, 1911, meeting at New York.

having a depth of a few inches within which the total stock of captured ions are actively moving to and fro. The formation of such a collision ionization envelope about the conductors of a high voltage transmission line is the fundamental feature of corona. Under normal atmospheric conditions the critical stress required to start ionization collision when regularly distributed is 76,000 volts per in. at a critical striking distance depending upon the distance between conductors and their diameter. This critical stress varies directly as the barometric pressure and inversely as the absolute temperature.

Conclusions

1. Ionization and the travel of ions under electric stresses are the causes of failure of the open atmosphere as an insulator and they are the cause of corona formation.

2. All ordinary failures of the atmosphere under stress are developed through ionization by collision which can be started under usual high-voltage electric stresses through the presence of some natural or antecedent supply of ions.

3. Variation in the supply of natural ions in open air is the cause of the erratic variation of critical loss-voltages. Such variations have little effect upon the values of the part-corona voltage that has increased the atmosphere loss by the small amount equal to the loss caused by the inevitable ion-convection current.

4. The figure of the electric field about the high voltage conductors determines the facility with which the migrating ions will concentrate the electric stress near the surface of the conductor and thus render the resulting corona irregular at all stages, causing it to be started and to be maintained at correspondingly lower voltages.

5. The turbulent elements introduced by variations in the amount of natural ionization have so small an effect upon the corona forming pressures, and the field irregularity factor above referred to is so nearly constant over a wide range of conditions, that the rational formula as developed should be found dependable to a reasonable extent.

6. The term "dielectric strength" as applied to the open atmosphere, from the inherent nature of things, can have no definite meaning.

7. The rupturing strength of the normal atmosphere rests upon two factors only, (1) quantity of ionization produced by the rupturing voltage, (2) the distance between the electrodes. The rupturing gradient varies from 300 kilovolts per in. (120 kilovolts per cm.) at lowest ionization to 3 kilovolts per in. (1-2 kilovolts per cm.) at highest ionization with no indication that the limits at either end of this range have as yet been found.

1. The failure of the oil as an insulator is due to ions liberated by the electric stress from the supply of free ions in the metals of the electrodes.

2. The electric stress required to detach ions from metals to the oil is much lower than the corresponding stress for a gas.

3. The further conclusion follows necessarily that a compressed gas must, in regard to insulating quality alone, be superior to oil.

THE JOBBERS' MEETING.

The Pacific Coast Jobbers' Association met in convention at Del Monte, January 19, 20 and 21, 1911. Friday was devoted to the business meeting and the balance of the time to social features and entertaining their friends. The great event was the golf tournament on Saturday and the weather, as is usual at Del Monte, was everything that golfers could ask for.

GOLF TOURNAMENT.

Pacific Coast Electrical Jobbers' Association—18 Hole Medal Play, Handicap.

		Gross	Hdcp.	Net
Burger	74-54	128	27	101
Carrigan	49-52	101	+11	112
Carter, H. V.	51-52	103	2	101
Dwyer	56-58	114	27	87
Elliott	66-57	123	17	106
Goodwin	48-45	93	+13	106
Gleason	48-58	106	+6	112
Graham	61-52	113	27	86
Gregory	65-50	115	14	101
Hall	68-51	119	5	114
Hillis	50-48	98	0	98
Holabird	50-48	99	+5	104
Poss	59-57	116	27	89
Sanderson	48-47	95	+4	99
Seaver	79-65	144	27	117
Squires	63-63	126	18	108
Wiggins	91-72	163	27	136
Lillard	54-53	107	5	112
Cole	65-66	131	27	104
Strong	71-59	130	27	103

The banquet in the evening was graced by the ladies, who seemed to greatly enjoy the witty remarks of the mere men. After N. W. Graham, winner of the cups, had told in minute detail just how he had accomplished the unexpected, Mr. Charles Wiggins was called upon to offer his excuses for winning the booby prize, a miniature silver cup of exquisite design, and in his happy way he told the story.

John R. Cole in a silent speech made the hit of the evening as it brought forth round after round of applause and laughter. C. C. Hillis read the following verses that will hereafter entitle him to the honor of poet laureate of the Jobbers:

THAT GOLF GAME.

If you list to me a moment
A story I will tell.
It's of a little game called golf
That some of us play well?

Now the tale I will unfold,
Concerns a game we played today
On the golf links of Del Monte,
Near the town of Monterey.

The players, mostly Jobbers,
With their allied guests, I think,
Put up a score which makes us sore
And drives us all to drink.

We played for a beautiful trophy,
Known as the "Jobbers' Cup."
The winner earned it fairly,
And I suppose he'll set 'em up.

We have a Golf Committee,
Russel D. and Billy G.
It twice helped Bill to win the can,
But Russ is still an also ran.

The winner tall of stature,
Broad of shoulders, thin of frame,
Proved a mighty classy golfer
And Newt Graham is his name.

And there was E. J. Dwyer,
As the schedule runner up;
The Lord can only tell you
How he tried to win that cup.

Also Frederick Brockway Gleason,
Charming, handsome, debonair;
His driving form was perfect
But the balls went everywhere.

There was still another player
Called Grouchy Sandy near and far.
His usual game is rotten,
But his swearing's up to par.

We also have a player
By the name of John R. C.
He is an awfully decent fellow,
But his game—Oh! Hully Gee!

Colonel Carter's mighty handy
With his golf sticks, now and then
He plays some holes in bogey,
And on others he takes ten.

And another classy golfer,
Andy Carrigan by name,
Once won the cup with an eighty-nine
But will ne'er score so low again.

The distinguished looking journalist,
The well known Mr. Strong,
Played a game that's most surprising,
'Cause he's not been playing long.

And the copper magnate, Seaver,
Made a really wondrous score.
We are mighty glad he's with us
And we hope he'll come some more.

The score that took the Booby Cup—
It really was a sin—
Was made by Charley Wiggin,
With the whiskers on his chin.

We must not forget our Albert,
Occasionally golfer, just for fun;
Who wastes no mental energy keeping score,
And says it can't be done.

He scores with a small contrivance
Often used for counting poles,
And it registers correctly
When his ball stays out of holes.

But if he once gets in the bunker
Or his ball gets in the rough,
He counts strokes only in the fair way,
For he thinks these quite enough.

And our old friend Tracy Bibbins,
Now so many miles away,
We could bet a million I could guess
What he's thinking of today.

There's a lot of other fellows
I would like to tell about,
But I'm an amateur at rhyming,
So I'll have to cut it out.

Everyone present said something more or less, until Albert Elliot, in most beautiful language echoed the sentiments of all present in their deep regret that Mr. Tracy Bibbins was absent on account of illness. W. H. Seaver of the American Steel & Wire Company delivered an able address on "Co-operation."

One of the principal results of the meeting were the suggestions for the California meeting of the National Electrical Supply Jobbers' Association in the spring of this year. A special train will convey the jobbers and their wives and the manufacturers from all Eastern points to Del Monte where the business sessions will last from Wednesday to Saturday. The exact date of the convention has not been fixed.

In addition to the business sessions which shall probably be five in number, there will be athletic feats and outings of all kinds. One afternoon will be devoted to a trip over the seventeen-mile drive. A lunch will be given to the ladies of the party at Pebble Beach.

The golf tournament will be played by the jobbers and also by the manufacturers. Splendid trophies will be played for in all the events.

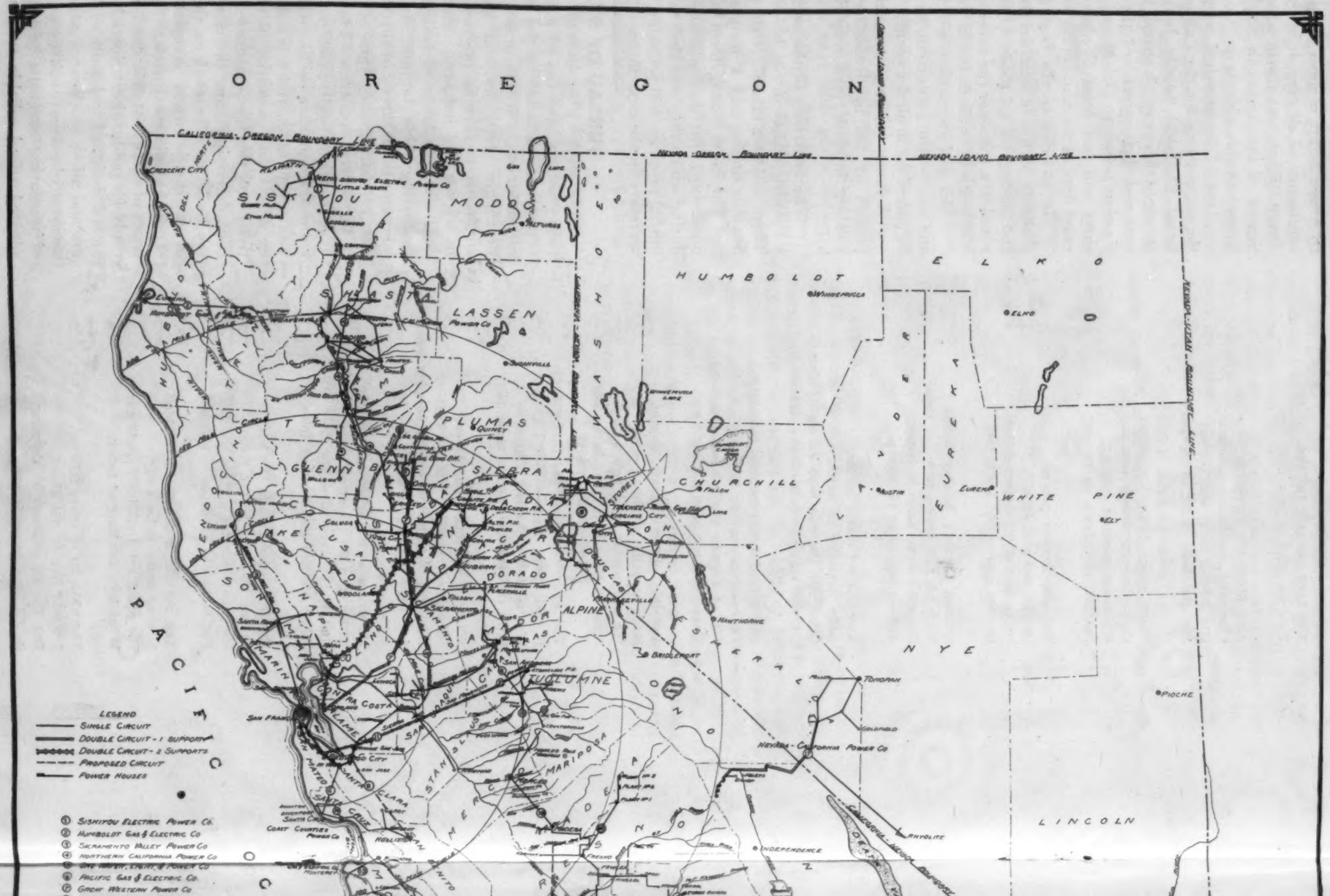
A dance will be given at the hotel one night and a concert by the band another night. There will be bowling, billiards, pool, trap shooting, tennis and push ball.

The festivities of the occasion will wind up with a Spanish supper in old Monterey on Saturday night. There will then take place the presentation of trophies, Spanish singing and dancing and a general good time.

The hotel management has given the jobbers to understand that they will own the hotel for the week during which they and their wives will be there. The official program will probably be issued by the general secretary in the near future.

BUREAU OF STANDARDS.

The work of the Bureau of Standards during the past year has been one of activity and interest. The researches conducted by the Bureau upon methods of measurement of length, mass, capacity, density, time, heat, light, electricity, and the properties of materials emphasize the central position of precision as a factor in science and industry. Measurements on standard cells and standards of resistance were made, intercomparing those brought from the foreign national laboratories and those of the Bureau of Standards, and also comparing the types of silver voltameters used in the several countries. The numerical value for the Weston normal cell, to be recommended to the International Committee on Electrical Units and Standards, was agreed upon, and it is hoped will soon be adopted by all civilized countries of the world. The conductivity and the temperature coefficient of copper have been determined, and the results will be published in the Bulletin. The work on the absolute measurement of current is nearly completed after several years' careful experimental work. The research on the properties of mica in standards of capacity is complete and ready for publication. Special electrical testing instruments, designed and built at the Bureau, are now in use and allow much more accurate and rapid measurement of current, voltage and power. The methods of measuring magnetic permeability and iron losses adopted afford reliable results


OREGON
CALIFORNIA-OREGON BOUNDARY LINE
NEVADA-OREGON BOUNDARY LINE
NEVADA-IDAHO BOUNDARY LINE
CRESCENT CITY
KLAMATH
SISKIYOU
MODOC
HUMBOLDT
LASSEN
ELKO
PLUMAS
GLENN
BUTTE
SIERRA
CHURCHILL
LAKE
EL DORADO
ALPINE
WHITE PINE
NYE
TUOLUMNE
MARIPOSA
LINCOLN
PACIFIC
LEGEND
SINGLE CIRCUIT
DOUBLE CIRCUIT - 1 SUPPORT
DOUBLE CIRCUIT - 2 SUPPORTS
PROPOSED CIRCUIT
POWER HOUSES
1 SISKIYOU ELECTRIC POWER CO.
2 HUMBOLDT GAS & ELECTRIC CO
3 SACRAMENTO VALLEY POWER CO
4 NORTHERN CALIFORNIA POWER CO
5 OHM VALLEY, LIGHT & POWER CO
6 PACIFIC GAS & ELECTRIC CO.
7 GREAT WESTERN POWER CO
NEVADA-CALIFORNIA POWER CO
CALIFORNIA-NEVADA POWER CO
RHYOLITE

TRANSMISSION SYSTEMS
CALIFORNIA — NEVADA

Compiled by

F. G. Baum and Company.,

Engineers and Constructors

San Francisco California

—·1911·—

PETROLEUM IN MEXICO.

The development of the oil fields near Tampico is having an important effect on the development of the entire Republic. The great importations of oil well machinery and oil well supplies have greatly increased the volume of business of the port of Tampico. The products of the fields furnish fuel, in part at least, for the railway systems of the country and will furnish Tampico with a cheap fuel which will greatly aid in its development as a manufacturing center.

From the petroleum produced gas is manufactured in Mexico City which not only supplies that metropolis with cheap light, but also with a cheap fuel by means of which the residents of that city will be enabled to heat their homes during the cold winter months, instead of suffering with the cold as heretofore. The streets of all of the larger cities as Mexico City, Guadalajara, Monterey, Chihuahua, Tampico, and others are being paved with asphalt distilled from the product of these fields. Roads in various parts of the Republic are being improved by the use of oil. All of these results are being brought about by new industries which have been made possible by the development of these oil fields and which give employment to large numbers of men and thus contribute to the general prosperity and development of the country.

The American Doheny syndicate controls companies and subsidiary companies engaged in the development of the oil fields in the Tampico section and in the marketing of the products made from the crude oil, whose holdings represent an investment of almost $30,000,000 gold. These properties include the oil producing properties of the Mexican Petroleum Company of California, at Ebano, San Luis Potosi, the Huasteca Petroleum Company, the Tamiahua Petroleum Company, and the Tuxpam Petroleum Company, all of which are operating just south of Tampico in the State of Veracruz. Other properties include the gas plant of the Mexican National Gas Company, at Mexico City, the paving plants of the Mexican Asphalt and Construction Company in Mexico City, Guadalajara, Puebla, Chihuahua, and Tampico, and those to be established in the near future in Monterey, Durango and Morelia.

Until recently the only producing oil wells in the Gulf coast section were those of the Mexican Petroleum Company at Ebano, San Luis Potosi. These will have furnished a steady production. But the production was not sufficient to permit the company to fill all of the contracts that were available. Since last August, however, the success of the Huasteca Petreleum Company, one of the allied or auxiliary companies in the fields at Juan Casianos, Veracruz, has made the oil properties of that company even more valuable than those of the Mexican Petroleum Comnay at Ebano. Well No. 7, the greatest oil well of the district, is claimed by the company to have a daily production of 28,000 barrels. It is said to be under a pressure of 3000 pounds, and at present to be shut in 50 per cent. Well No. 6, which is claimed by the company to be a 15,000 barrel well is shut in entirely under a 570 pound pressure.

The oil goes through the pipe line from the field at Juan Casiano to Tampico. The largest pipe line delivery in one day up to the present time is 30,000 barrels, but when the storage facilities at Tampico are completed the company expects to pump 32,000 barrels daily. About 20,000 barrels are shipped daily by rail from Tampico. A part of this goes to Ebano to be stored and the remainder to the gas plant in Mexico City.

The greatest problem now confronting this company is that of storage capacity. The storage plans include 24 steel storage tanks each having a capacity or 56,000 barrels. Nine of these have already been completed and it is expected that the remainder will be finished at the rate of five per month. Work has already been commenced on a re-inforced concrete reservoir at Tampico that will hold 1,250,000 barrels. It is said that as soon as possible work will be commenced on another reservoir of the same kind, but having a capacity of only 750,000 barrels, at the Geronimo pipe line station. A third reservoir of the same kind, with a capacity of 500,000 barrels, will be built, according to the plans of the company, about one mile from the Casiano field.

All of this construction work necessitates the purchase of large quantities of supplies. One hundred mule teams and scrapers have been brought in from El Paso, Tex., 22 carloads of lumber have been brought here from the Chihuahua lumber mills, and 75 carloads of machinery have been brought in through El Paso. In addition large quantities of lumber, machinery, oil well supplies, etc., are constantly arriving in Tampico by steamer from the United States, while thousands of barrels of cement have been brought in from Germany.

The company is also preparing to build a 75-mile steam railway from the Ebano fields across its property to the Tuxpam River, at a cost of about $1,000,000 gold. The ties are said to be already on the ground. The company has its own telephone line from Ebano to Juan Casiano and also between Tampico and Casiano. It also has a concession to lay a pipe line under the Panuco River, by which it will be able to deliver oil at the Waters-Pierce tanks at Tampico.

The paving company now has a large force of men working on the streets of Tampico. The streets are being prepared for asphalt and the curbing laid. The company has installed a concrete mixer and an asphalt mixing plant. Most of the machinery comes direct from the United States. Many mules and wagons have also been imported by it for the street work.

The gas plant in Mexico City is said to have a capacity of 1,550,000 feet per day, but it is expected that this will be ultimately increased to 5,000,000 cubic feet per day, in order to meet the demand for lighting and fuel gas.

Another company that has been successful in finding oil in this district is the Aguila Petroleum Company (Pearson & Son). This company is said to have an abundant supply of oil from its wells at Tanguijo and Portreros del Llano, Veracruz, in this district. [It is announced by the Mexican Herald of January 5th that the Pearsons have brought in a new well at Portreros del Llano the flow of which is estimated at 100,000 barrels a day. It is flowing in a great stream

100 feet high and steps are being taken to save the flow and prevent such a conflagration as destroyed the great Dos Bocas gusher.] The company now has three large barges which are used to transport the oil to Tampico. In addition the company is having Captain Hermanson, of the Tampico Navigation Company, build for it six large steel barges to be used for the same purpose. These barges will have a carrying capacity of 1000 barrels each.

This company also has the entire output of the wells of the Oil Fields of Mexico Company, at Furbero, Veracruz, about 55 miles from Tuxpam. This latter company is putting forth every effort to bring in new wells and increase its production. Scores of drillers have been brought to the field from the United States and been put to work drilling wells in the proved oil field. The product is pumped through the pipe line of the company from Furbero to Tuxpam, about 55 miles, from whence it is shipped by steamer to the Pearson refinery at Minatitlan.

All of the companies which had to shut down on account of the rainy season and high water have resumed operations. Several new companies have also commenced work. Among the new companies is the Gulf Coast Oil Company, under the management of Mr. A. H. McKay and Mr. J. E. Mulligan. Mr. Edward Williams has also commenced drilling near Panuco.

A NATIONAL HYDROELECTRIC COMMISSION

The executive committee of the National Electric Light Association recently passed the following resolutions:

Whereas, The condition of the laws and regulations relating to the public lands of the United States Government is so complicated, unsatisfactory and unsettled that the financing and commercial development of new enterprises in connection with public lands is rendered practically impossible; and

Whereas, The immediate development of the idle water powers of the nation is of importance to the whole people in that it brings to immediate use an indestructible natural resource that would be otherwise lost or idle, and conserves coal, oil, gas and other fuels that are limited in amount and not subject to replacement; and

Whereas, The National Electric Light Association is particularly interested in the situation pertaining to public lands of the United States in connection with the development of water powers; and

Whereas, Much of the difference of opinion upon the subject of water-power arises from the difficulty of obtaining a clear comprehension of all the facts; now, therefore, be it

Resolved, That this Association does respectfully urge that a competent commission, composed of members of the Senate and House of Representatives of the United States, together with other persons familiar with the financial and other practical aspects of the situation, be appointed with full authority to collect the evidence, and for that purpose to hold full and complete open hearings in different sections of the country; and be it further

Resolved, That this Association does respectfully urge that such commission be appointed at as early a date as possible to the end that its meetings may be held between the adjournment of the present session of Congress and the reassembling of the new Congress in the hope that such commission should report upon such reassembling and Congress be thereby enabled to take prompt action in the enactment of such laws as will permit the development of the natural resources of the country in such a manner as shall render them of the greatest possible use to all of the people.

CALIFORNIA PUBLIC SERVICE COMMISSION.

The conference measure prepared by Percy Long of San Francisco, providing for a public service commission in California, which is to act, theoretically, at least, until such time as the Constitutional amendment providing for a public utilities commission is adopted by the people, has been introduced in the Assembly by W. A. Sutherland of Fresno and by Senator Burnett in the upper house.

In connection with the bill several other bills to provide for the carrying out of its terms were introduced and also a constitutional amendment giving municipalities, counties or the State the right to award indeterminate franchises to public service corporations and allowing them to take over the franchises.

The bill creates a commission of three, to be appointed by the Governor, who shall draw a salary of $8000 a year each. Under the bill the commission has the power to regulate stock and bond issues and regulate rates outside of incorporated cities. Counsel at $3000 may be employed and a secretary is to be named by the commission, to draw $4200 a year. All public service corporations except railroads will be under the supervision of the commission.

One of the accompanying bills provides that no injunction shall be granted restraining the issuance, sale or offering for sale of any municipal bonds for public improvements or public utilities.

CALIFORNIA CONSERVATION BILLS.

Four conservation bills have been introduced at the California legislature. The most important is that providing for a conservation commission of five members, to be appointed by the Governor, for the purpose of investigating, gathering data and reporting at the next session of the Legislature what legislation is necessary. This commission will gather the facts concerning water sources, water-power, irrigation, reclamation, forestry and mining. The bill appropriates $50,000 for the services of experts and other expenses, the commissioners themselves to work without compensation.

The second bill contains specific regulations as to how water appropriations may be made in the future. It provides for a board of control of three members. Rights already acquired are not to be affected or disturbed. Rights in the future for the use of water to generate electricity and power are not to be granted for a longer period than twenty-five years.

The third bill amends a civil code section to conform with the twenty-five-year limitation.

The fourth measure is a constitutional amendment which provides for this limitation and gives the legislative body of a city or county the right to fix rates.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE

Technical Publishing Company

E. B. STRONG, President
A. H. HALLORAN, Vice President and Managing Editor
C. L. CORY, Secretary.

DIRECTORS

R. J. DAVIS A. M. HUNT A. H. HALLORAN C. L. CORY E. B. STRONG

604 MISSION STREET, SAN FRANCISCO

EASTERN OFFICE, 140 NASSAU STREET, NEW YORK
C. N. MANFRED, Eastern Manager

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	5.00
Single Copies, Current Month	each	.10
Single Copies, prior to Current Month	"	.25

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office *ten days in advance of date of issue.* New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1899.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

History of Napa and Its Gas Business 87
By E. C. Jones.

Petroleum Production 91

Water Laws of Washington 92
By John C. Stevens.

Objectionable Features of Public Service Commission Laws .. 93

Corona 95
By Harris J. Ryan.

The Jobbers' Meeting 96

Bureau of Standards 97

Map of Transmission Lines of California 98

Petroleum in Mexico 100

National Hydroelectric Commission 101

California Public Service Commission 101

California Conservation Bills 101

Editorial 102
Corona.

Personals 103

Trade Notes 103

New Catalogues 103

Patents 104
Electrical Motor.
Electric Vehicle Charging Plug.
Lightning Arrester.
Fluid Measuring Device.
Portable Dam.

Industrial 105
Switchboards for Japan.
The "Ironclad Exide" Battery.

News Notes 107

Corona

It has long been a matter of common observation that high-tension electric conductors are encircled by a faint bluish glow at night. This ocular manifestation of high voltage is accompanied by an audible indication, or hissing noise, which has been aptly compared to that of a hive of bees. It was Steinmetz, we believe, who first applied the name "corona" to this phenomena and showed that it was merely a case of disruptive conduction through the surrounding air, which consequently becomes luminous, as does likewise the Geissler tube and the Moore light. Corona has been investigated by many engineers and physicists whose recorded data contained many apparent inconsistencies.

The tremendous task of bringing order out of this chaos has been accomplished in Professor Harris J. Ryan's masterly paper on "Open Atmosphere and Dry Transformer Oil as High Voltage Insulators," presented to the American Institute of Electrical Engineers through the San Francisco Section and briefly abstracted elsewhere in this issue. This paper is a sequel to that presented to the Institute by the same worker in 1904, and like its predecessor, is destined to become a classic. It brings this branch of science to that stage known as the deductive, whence it is but a short step to the final stage of formal development.

The paper is largely devoted to an explanation of corona by means of the ionization theory and to experimental confirmation thereof. According to this theory a thin layer of air around an electric wire contains ions, or electricity carriers, which move rapidly to and fro in the electric field surrounding the wire. Whereas ordinary air is an insulator, air thus ionized becomes a conductor and is made luminous. Corona is thus seen to be the first stage in the breakdown of air as an insulator, succeeding stages being the spark and arc wherein the continuous conduction of the electrode vapor takes the place of the disruptive conduction of the ionized air.

The electronic theory, here employed to such good advantage, is the most promising path toward the solution of the problem as to what is the ultimate nature of electricity. By its means atmospheric electricity, as exemplified in the lightning flash, is found to be due to an electrical charge of the clouds caused by ionization through the ultra-violet rays of the sun. The polar auroras likewise may be traced to the discharge of ionized solar dust into the earth's atmosphere, this dust being deflected to the poles by the earth's magnetic field. So while the theory may be distasteful to the engineer it may yet be the means by which his electrical problems will be overcome.

While these theoretical deductions are of great scientific interest, they are as yet of little practical value. They show the necessity for large conductors and wide spacing in order to reduce the energy loss occasioned by corona. They teach the advisability of keeping the wires clean so as to minimize the number of natural ions which reduce the voltage at which corona may start and they show why these losses are greater at high altitudes where the air density is low. Corona also places a limit beyond which higher voltages are not economical. But for a time, at least, there is little likelihood of corona becoming a crown of thorns to the transmission engineer

PERSONALS.

C. R. Ray, manager of the electric light and power system at Medford, Ore., was a recent San Francisco visitor.

Leon Bly, secretary of the Tehama Light & Power Company of Red Bluff, was a recent San Francisco visitor.

T. E. Bibbins of the General Electric Company, is seeking health and taking a much needed rest at Honolulu.

W. S. Heger, California manager of the Allis-Chalmers Company, spent the past week in Los Angeles and vicinity.

H. E. Adams, general manager of the Stockton Gas & Electric Company of Stockton, recently spent a few days at San Francisco.

E. L. Haines, of J. G. White & Co.'s San Francisco staff, who was confined to a hospital by illness for several weeks, is now convalescent.

H. Carl Strong, general manager of the Ketchikan Light & Power Company, arrived at San Francisco last week from Ketchikan, Alaska.

H. R. Noack, manager of Pierson, Roeding & Co., recently returned to his San Francisco office after completing a tour of the Pacific Northwest.

A. J. Myers, Pacific Coast district manager for the Wagner Electric Manufacturing Company, is visiting the company's factory at St. Louis.

J. A. Cranston of Portland, who has extensive hydroelectric power interests in the Pacific Northwest, arrived at San Francisco last Monday.

F. A. Burnham, superintendent of the Tonopah Water Company, left for Carson, Nev., last Sunday after spending a few days at San Francisco.

H. C. Keyes, of the Sacramento Natural Gas Company, of Sacramento, spent last Sunday in San Francisco with his bride on a honeymoon tour.

R. L. Van der Naillen, superintendent of the Oro Water, Light & Power Company's hydroelectric plant, was a recent San Francisco arrival from Oroville.

W. J. Stadelman has resigned as manager of the Santa Monica Bay Home Telephone Company of Santa Monica, Cal., being succeeded by L. R. Weaver, formerly of Richmond, Ind.

G. C. Townsend has resigned as manager of the Butte exchange of the Rocky Mountain Bell Telephone Company to represent the National Packing Company at Billings, Montana.

John Boulware Bubb was the only midwinter graduate in the mechanical engineering department at Stanford University out of the sixty-three students who were recently granted degrees at that institution.

Thomas Mirk, of Hunt, Mirk & Co., left during the past week for San Diego, where the firm are installing additinal Westinghouse-Parsons turbines and condensing apparatus for the San Diego Electric Railway Company.

Wynn Meredith, Pacific Coast manager for Sanderson & Porter, the New York firm of electrical engineers, has gone to Victoria, B. C., on business connected with the Jordan river development of the British Columbia Railway & Power Company.

Four of the Western Union Telegraph Company's officials arrived at San Francisco last Sunday to confer with C. H. Gaunt, the general superintendent of the Pacific division, who is convalescent after a severe illness. They are: E. Boening, district commercial superintendent at Seattle; W. J. Smith, commercial agent in the same district; Hugh McPhee, district commercial superintendent at Los Angeles, and C. E. Van Landingham, commercial agent.

George R. Field, assistant general manager of the Great Western Power Company, made a trip covering the hydroelectric transmission lines of the system in the valleys between the generating plant and San Francisco during the past week.

D. C. Henny, a United States Government engineer connected with the Reclamation Service with headquarters at Portland, has arrived at San Francisco in company with E. J. Hopson for the purpose of letting contracts for work on the Truckee-Carson project in Nevada.

H. A. Lardner, manager of the Pacific Coast branch of J. G. White & Co. of New York, left last Monday for Los Angeles, where he expected to meet E. G. Williams, the firm's general superintendent of construction, and make an inspection of the work in progress in Southern California.

W. H. Phillips is chief engineer of the modern electric power plant, in the new eight-story building of the Young Men's Christian Association on Golden Gate avenue, which was recently constructed at a cost of more than $600,000. He was formerly connected with the United States Navy and was also a chief engineer of U. S. Army transports. Raymond P. Perkins, who was formerly connected with the power plant at the Presidio, is first assistant engineer and F. D. Rees is the second assistant.

TRADE NOTES.

The Fort Wayne Electric Works have the contract for the second of series of haulage engines for scraping gravel to the Grant Gravel Company, to be used in their gravel pits at Pleasanton, consisting of 125 h.p. motor, 2200 volts, direct geared to No. 6½ steel frame Hendrie Bolthoff hoist.

Smith, Emery & Company, engineers and chemists, announce a re-organization of their business, made necessary by its rapid growth and development. The capital stock has been increased to $100,000, and the latest bookkeeping and filing systems are being installed. The Los Angeles establishment, which has hitherto been a separate corporation, under the name of Smith-Emery Company, now becomes a part of Smith, Emery & Company, the parent organization. The laboratories and offices of the company occupy the entire building at 651-3 Howard street, San Francisco, and the Los Angeles branch occupies the entire building and lot, owned by the company, at 245 So. Los Angeles street, in that city. The firm has at present on its regular staff twenty-two engineers, chemists, and assistants, and a staff of six associate engineers, and has extensive Eastern, Canadian and European connections.

NEW CATALOGUES.

The Electric Storage Battery Company has issued an interesting bulletin of facts concerning the new "Ironclad Exide" battery for electric vehicles.

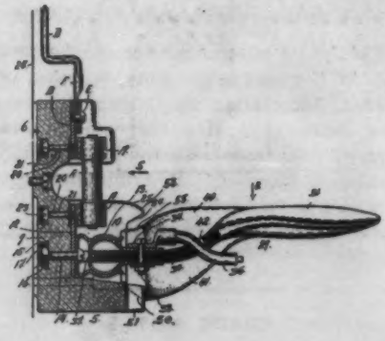
Bulletin No. 130 from the Electric Storage Battery Company is devoted to the installation of the "Chloride Accumulator" for the Slate Belt Electric Street Railway Company of Pen Argyl, Pa.

Catalogue No. 115 from the Hooven, Owens, Rentschler Company, Hamilton, O., is devoted to series N Hamilton power pumps, belt or rope driven from engine, motor or line shaft. Chas. C. Moore & Co., engineers, are general Pacific Coast representatives.

Boiler Tube Cleaners are listed in a 48-page 5x7 in. catalogue from the Lagonda Mfg. Co., Springfield, O., devoted to Weinland tube cleaners, both water and air driven, turbine cleaners, ball and thrust bearing type and quick repair heads. Chas. C. Moore & Co., engineers, are general Pacific Coast representatives.

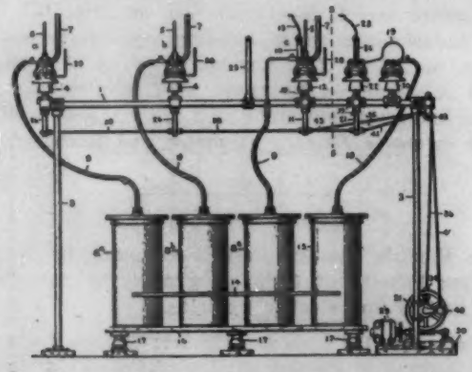
PATENTS

981,622. Electric-Vehicle-Charging Wall-Socket and Plug. Jasper Newton Davis, Denver, Colo. In an apparatus of the class described the combination of a socket block whose body portion is composed of insulating material, said block being equipped with socket contacts and a co-operating socket plug provided with electrodes adapted to engage the contacts of the block, and electrical conductors connected with the respective electrodes, the body of the plug being



composed of insulating material and having a handle offset therefrom, the body portion having separated perforations formed at a point below the angle of the handle through which the said conductors pass, the plug being also equipped with upper and lower webs forming barriers between the conductors, and their respective contacts and electrodes, the said webs being interposed between the perforations, substantially as described.

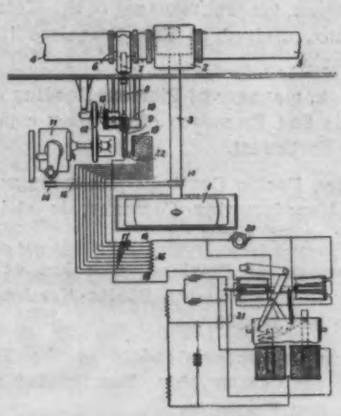
982,224. Lightning-Arrester. Elmer E. F. Creighton, Schenectady, N. Y., assignor to General Electric Company. The combination with a three-phase system having three conductors, of four electrolytic condensers with correspond-



ing terminals electrically connected and the other terminals of two of said condensers directly connected to two of said conductors, and means whereby either of the remaining two condensers may be connected to ground and the other connected to the third conductor.

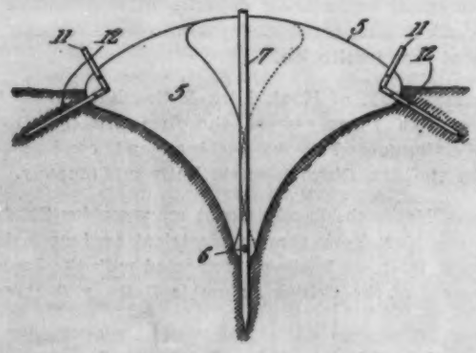
981,881. Electrical Motor. Harry A. Rhodes, Denver, Colo., assignor to The Universal Motor Company, Denver, Colo. An electric motor, comprising a rotatable member provided with a series of electro-magnets, a commutator whose segments are respectively connected with the coils of the said magnets, positive and negative brushes engaging the commutator, and a stationary armature member eccentrically arranged adjacent to the magnets, means for varying the air gap between the armature and the magnets, the parts being so arranged that the magnets are energized on the approaching side of the shortest air gap, between the magnets and the armature member, substantially as described.

981,789. Fluid-Measuring Device. Samuel L. Nicholson, Pittsburg, Pa ., assignor to Westinghouse Electric & Manufacturing Company. The combination with a fluid-propelled prime mover, a throttle, valve or gate, a rack operatively connected to the gate, and a governor for automatically varying the valve or gate opening according as the speed



of the prime mover varies, a resistance having a plurality of intermediate taps severally connected to a series of stationary contact members, a movable engaging contact member secured to the rack, and a source of energy for the resistance, of an electric measuring instrument for continuously recording the energy consumed in the active portion of the resistance.

981,849. Portable Dam. Ethan A. Ernst, Lamar, Colo., assignor of one-third to William E. Nogal and one-third to William S. Holbert, Lamar, Colo. A portable dam comprising pivotally connected wings swinging transversely of the ditch, and a support carrying said wings, said support comprising a rod extending in front of the wings, and projecting



below the same, the projecting end of the rod being adapted to be inserted into the bottom of the ditch, and the upper end of the rod extending in a bend across the top edges of the wings, and downwardly behind the same, the pivot of the wings being carried by said front and rear portions of the rod, and the wings being located therebetween.

INDUSTRIAL

SWITCHBOARDS FOR JAPAN.

BY EMIL BERN.

Two switchboards of considerable size have lately been built by the General Electric Company of Schenectady, New York, for the Koyoto Municipal Water Works, Japan.

The generating station board is shown in Fig. 1. It is forty feet long and consists of twenty-four three-section marble panels, supported on a pipe framework. This framework also carries the oil switches, disconnecting switches, instrument transformers and several sets of busses.

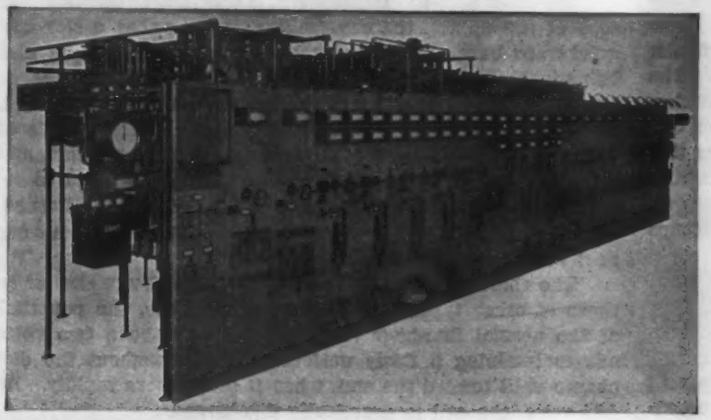


Fig. 1. 6600 and 35,000 Volt Switchboards for Municipal Water Works, Kyoto, Japan.

The station equipment controlled from this board consists of: Two turbo exciters, 125 volts, 125 kilowatt; five 3-phase turbo generators, 6600 volt 1500 kilowatt, 60 cycles; three 3-phase outgoing lines, 6600 volts, to substation; one bank of transformers 6600/3500 volt; seven 3-phase feeders, 3500 volt; three 3-phase, 4-wire feeders, 3500 volt.

Each exciter has a triple pole, double-throw switch and a double set of busses so arranged that either exciter can be used to excite the generator fields, while the other is used for station lighting and auxiliary power.

The alternating current generator panels, in addition to the usual instrument and synchronizing equipment, have reverse current relays for automatically tripping the oil switches on a reversal of current which might result from a short

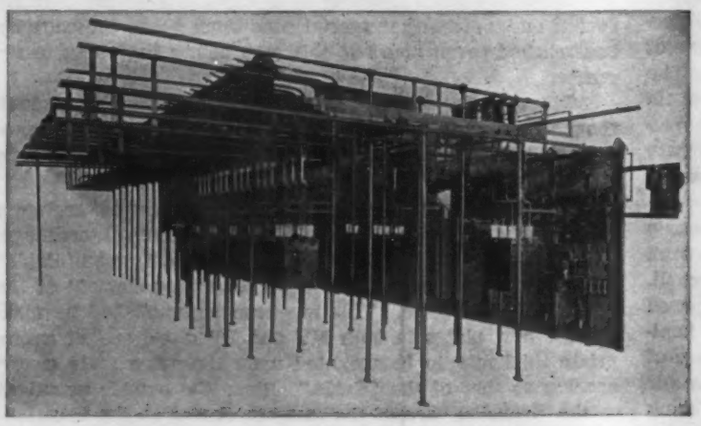


Fig. 2. Arrangement of Switching Apparatus for Municipal Water Works, Kyoto, Japan.

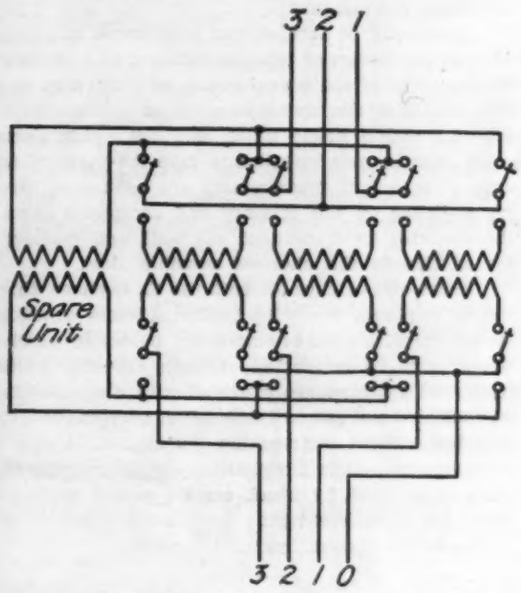


Fig. 3. Diagramatic Representation of Transformer Connections and Method of Cutting in Spare Units.

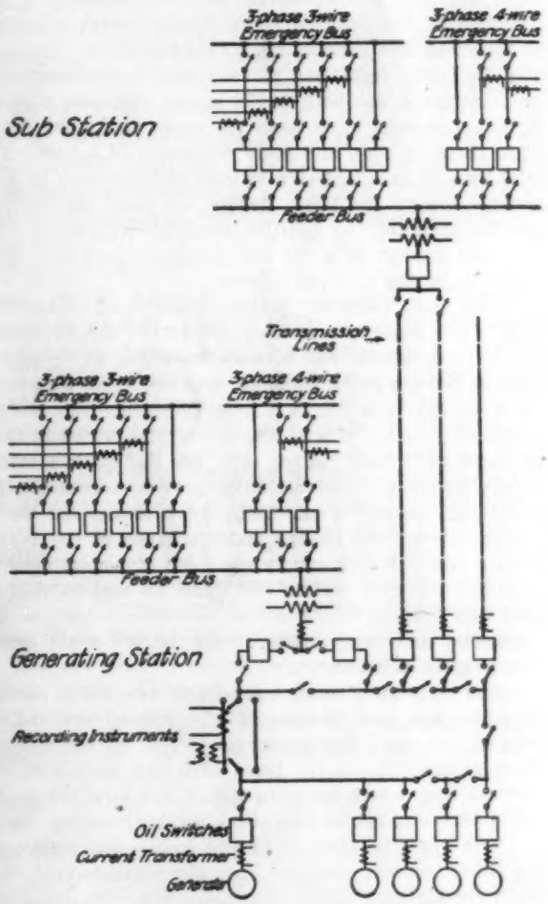


Fig. 4. Diagramatic Representation in Generating Station and Substation Wiring.

circuit in the winding of the generator or from a failure of the prime mover.

The panels controlling the different lines and feeder circuits are equipped with inverse time limit overload relays in connection with automatic oil switches in addition to the indicating instruments.

Continuity of service was considered of primary importance in the design of this switchboard and to insure this, an arrangement of spare equipment, as illustrated in Fig. 3, was adopted. For the transformer bank consisting of three 750 kilowatt single phase units, one spare transformer of the same capacity was installed to take the place of any disabled unit. These four transformers are connected through transfer switches on the primary and secondary sides to enable the operator to disconnect any unit and connect the spare for service in the shortest possible time.

Spare oil switches for both the three-phase, three-wire and the three-phase, four-wire feeder systems connect the main feeder bus with a set of emergency busses to which any feeder circuit can be connected through transfer switches. The feeder oil switches are provided with disconnecting switches on each side and can be taken out of service for inspection and cleaning without interrupting the circuit. Fig. 4 shows this arrangement. This illustration also shows clearly the ring bus system used, by which certain groups of feeders may be connected to different generators independent of other groups or the whole system operated together.

THE "IRONCLAD-EXIDE" BATTERY.[1]

BY BRUCE FORD.

The "Ironclad-Exide" battery is of the lead sulphuric acid type, and its principal feature of novelty resides in the construction of the positive plate, together with other features of mounting and connecting, which will be brought out later. The flat plate form was many years ago recognized as the best electrode for both positive and negative plates. Two forms of design have been in vogue for many years—the plain plate or slab, and plate composed of a number of parallel bars or rods laid side by side and mounted in a suitable frame. Where the latter design has been employed, it has usually been for the positive electrode or pole plate. This has been true in both the lead sulphuric acid type of battery and also in the alkaline battery.

The new "Ironclad" positive plate is of this design. Its grid is composed of a number of parallel vertical metal rods, united at their tops and bottoms integrally to top and bottom frames, the top being supplied with the usual conducting lug. Each vertical rod forms a core surrounded by a cylindical pencil of peroxide of lead active material, which in its turn is enclosed by a hard rubber tube supplied with a multiplicity of fine horizontal laminations to provide access for the electrolyte to the active material, and passages for the flow of current during the charge and discharge of the plate. The rubber tube fits very snugly upon the active material, and its elasticity allows a certain come and go, maintaining its relation with respect to the active material during the alternate expansion and contraction of the latter in the process of charge and discharge.

The cylindrical form is peculiarly adapted to perform this function, and the amount of electrolyte surrounding each tube is just about the correct proportion for the active pencil. Each rubber tube is furnished with two oppositely disposed vertical ribs, which serve to stiffen and strengthen the laminated tube and act as separators, entirely taking the place of

The negative plate is of the form used successfully for the ribs commonly provided upon the separators of cells using plain flat plates.

[1] Abstract of paper presented at the meeting of The Electric Vehicle Association of America, New York, January 17, 1911.

so many years in the "Exide" Battery, but in order to enable it to withstand not only the increased capacity, but also the greatly increased life of the new "Ironclad-Exide" positive plate, it has been made somewhat thicker.

The grid of the negative plate is of the standard "Exide" design, facial horizontal bars on one face of the plate being in staggered relation to the bars on the opposite face, the whole, being united by vertical ribs at intervals.

The wood separator, consisting of a plain sheet of veneer of appropriate thickness, is interposed between the face of the negative plate and the vertical ribs of the rubber tubes of the positive plate.

The positive and negative plates respectively are united into groups, their lugs being burned to pillar straps in the ordinary way.

An improvement on the pillar strap has been incorporated for the "Ironclad-Exide" Battery, by slightly pointing the tops of the pillars, thereby making it somewhat easier and quicker to burn the connections. This modification is also being incorporated in the straps for standard "Exide" cells.

The connector used in the "Ironclad" Battery is not rigid, as it is in the "Exide" Battery, but is made of thin sheets of copper lead plated to protect the copper against corrosion, and provided with an alloy terminal at each end received to receive the pillar of the strap, to which it is integrally burned.

A battery assembled with these connectors has a very neat and business-like appearance.

The characteristics of the cell in discharge are similar to those of other types of lead storage batteries, the potential at the normal four-hour rate starting well above two volts and maintaining a fairly uniform value throughout the discharge until toward the end, when it drops more rapidly. At 1.75 volts, the cell is practically discharged.

Similarly its characteristics during charge are like those of other lead batteries, the voltage remaining fairly uniform throughout the major part of the charge and rising rapidly to its final value toward the completion of the charge.

The internal resistance of the cell, being about the same as that of an "Exide" cell of corresponding size, the variation in capacity with change in rate is about the same. While its capacity decreases at a less than constant rate of change with increase of discharge rate, yet its capacity becomes greater at an increasing rate as the discharge rate becomes less. This is a valuable characteristic of the lead cell when the elapsed time of discharge is extended.

The new battery is rated initially at four and a half hours at a current corresponding to the four hour rate of an "Exide" Battery of the same size. For example, an MV "Ironclad" positive plate is rated at 7 amperes for four and a half hours. As the battery is worked, the capacity will increase to from five and a half to six hours or even more. Cases have been recorded under somewhat special conditions where the capacity has reached seven hours at this rate before beginning to decrease.

The gain in capacity is not merely temporary, and although increasing at a comparatively rapid rate it decreases very slowly so that the actual capacity is considerably above the rating for practically the entire life of the plates.

The dimensions of the elements of the new battery were proportioned to make "Ironclad-Exide" elements interchangeable with those of the "Exide," so that plates from an "Exide" Battery can be renewed with a proper fitting element of the "Ironclad-Exide" type. This has been accomplished by making the new plates in both MV and PV sizes, and of appropriate thickness to be mounted upon the same plate center spacing as that of the "Exide." Since the outside negatives in the "Ironclad" are of the same thickness as the negatives of the "Exide" Battery, the over all dimensions of an "Ironclad" element are therefore the same as the over all dimensions of an "Exide" element having the same number of plates.

NEWS NOTES

FINANCIAL.

EUGENE, ORE.—The Council has taken steps to install a municipal lighting system and the matter will be presented to the voters at the April election.

VENICE, CAL.—A bond election will be held in the near future to vote on the proposition of issuing and selling bonds for an extension of the salt water mains.

FALLS CITY, ORE.—At the special election held in Falls City last week the proposition to issue city bonds to the amount of $25,000 for installing a water system was carried by a vote of 148 to 21.

HOOD RIVER, ORE.—A special city election will be held here for the purpose of submitting to the voters the question of an issue of bonds in the sum of $38,900 for the purpose of purchasing the water plant and the distributing system used by the Hood River Light & Power Company.

ANAHEIM, CAL.—The City Council passed an ordinance providing for holding a special election on January 30th to vote on issuing bonds in the sum of $90,000 for the construction of a sewer system and $85,000 for the acquisition of certain electric light appliances and additions to the municipal light and water works building. The bonds will bear 5 per cent interest per annum payable semi-annually.

INCORPORATIONS.

SAN FRANCISCO, CAL.—The Leitch Electric Company has been incorporated by Chas. A. Leitch, Warren Vance and D. A. Turnbull, with a capital stock of $25,000.

SAN FRANCISCO, CAL.—The Sierra-Blue Lakes Water & Power Company has been incorporated by Eugene J. Sullivan, Walter E. Sullivan and Geo. H. Richardson, with a capital stock of $75,000.

SAN FRANCISCO, CAL.—The Sacramento Short Line has been incorporated by B. M. Aikins, R. P. Henshall, Luther Elkins, G. W. Mordecar, R. V. Whiting, M. Schmulo and F. L. Stewart, with a capital stock of $10,000,000.

VANCOUVER, WASH.—The Northwestern Electric Company, capital $5,000,000, has been incorporated by D. A. De Yarmon of this place, B. C. Condit of Oakland, Cal.; C. E. S. Wood, N. E. Parker and Erskine Wood of Portland. The new company proposes to develop power on the Lewis river.

SEWARD, ALASKA.—A. C. Brown and other citizens of this place have organized the Seward Alaska Electric Company, capitalized at $200,000 for the purpose of the construction of a telephone line from this place to mining camps on Cache creek and later to Iditarod. Orders for wire and equipment have been placed.

ILLUMINATION.

FULLERTON, CAL.—R. C. Keen of Monrovia has completed arrangements for an electric store in Fullerton.

COTTAGE GROVE, ORE.—The Cottage Grove Light & Power Company has been granted a 25-year franchise.

ORLAND, CAL.—C. R. Wickes has been granted a franchise for an electric light and power plant here. Work on it is expected to commence within two months.

EUGENE, ORE.—Preliminary steps are being taken by the City Council toward establishing a municipal light plant, the current from the city's power plant at Waterville to be used.

ANAHEIM, CAL.—The city of Anaheim has let a contract to Mr. Orr to erect reinforced concrete electric poles on the Broadway extension at 35c per lineal foot.

EL CENTRO, CAL.—The Holton Power Company will at once erect a large gas plant here and has let a contract to Allis-Chalmers Company for a gas producer plant. The plant will cost $250,000.

METALINE, WASH.—W. W. Warmer, representing the Sterling Silver Lead Company, has been granted a franchise to operate a telephone and electric power system and to construct a system of water-works here.

KLAMATH FALLS, ORE.—Mayor Sanderson is in receipt of a communication from the Rogue River Valley Gas Company inquiring as to the possibility of securing a franchise for the establishment of a gas plant here.

BENSON, ARIZ.—A franchise has been granted R. G. Arthur for an electric light power plant at Benson. A company will be incorporated shortly with M. J. Cunningham, S. F. Meguire, W. M. Adamson and Pete Jensen.

SAN FRANCISCO, CAL.—At the annual meeting of the stockholders of the City Electric Company the following directors were elected: Mortimer Fleishhacker, Herbert Fleishhacker, L. Schwabacher, W. Arnstein, S. L. Napthaly, Wm. L. Gerstle, J. J. Mack, S. Scheeline and A. Schwabacher.

SEATTLE, WASH.—The Board of Public Works has passed favorably upon the project for the construction of a 2000 h.p. hydroelectric plant on Lake Union, utilizing the waste water system. A large storage reservoir will probably be constructed in Volunteer park and a steel pipe will be installed to conduct water to the plant.

ROSWELL, ARIZ.—The Berrendo Irrigated Farms Company which bought the Roswell Electric Light & Power Company's plant last year, is preparing to spend $250,000 in a new building and additional machinery and equipment to furnish power for pumping water for irrigation and for a street and suburban railway that is to run from St. Mary's Hospital on the Milne Bush tract.

MONTEREY, MEXICO.—Tenders will be received by the Monterey Railway, Light & Power Company of Monterey, Mex., up to March 1st, 1911, at the office of the company, for the erection of a gas plant to serve the requirements of Monterey, Mexico, a city of 85,000 inhabitants, with first class railroad facilities. Plans and specifications may be seen at the company's offices. Copies of plans and specifications, form of tender and other necessary information will be furnished to responsible bidders on request. Separate or supplemental tenders will also be received at the same time for the laying of gas mains and curb connections. All interested parties should communicate with Vice-President Lewis Lukes, Monterey Railway, Light & Power Company, Ltd., Apartado P. O. Box 58, Monterey, N. L., Mexico.

TRANSMISSION.

EUGENE, ORE.—It is reported that the Oregon Power Company will soon begin work on the construction of the proposed electric plant at Martins Rapids.

REDDING, CAL.—A water right claiming 250,000 inches in the Sacramento River at a point three miles north of Redding has been located by Geo. L. Bancroft, of Denver, Colo. Bancroft is a civil engineer. The location is the largest ever made in Shasta County. The notices are posted on the east bank of the river a little below Middle Creek station. The

location of the water right was made this week by George W. Bush, attorney for Mr. Bancroft, in obedience to telegraphic orders received from Denver. The Sacramento Valley proper begins at Middle Creek, three miles above Redding. It is there that the canyon walls recede and the farming land appears.

TRANSPORTATION.

GREAT FALLS, MONT.—Fire recently destroyed the car barns of the Great Falls Electric Company, causing a loss of $20,000.

MEDFORD, ORE.—Dr. J. F. Eddy has applied for a franchise to construct an interurban trolley line here in the interest of outside parties.

VALDEZ, ALASKA.—It is reported that the construction of an electric railway six miles long from this place to Mineral Creek will soon be under way.

BUTTE, MONT.—The Butte Driving Club is preparing to build a street railway line from Reagan's roadhouse on the flat to the Five-Mile, in case the street railway company does not take action.

OAKLAND, CAL.—The East Shore and Suburban Railway Company between Richmond in Contra Costa County and Oakland and other cities in Alameda County, was acquired last week by the United Properties Company, recently formed, with F. M. Smith as one of the leading factors.

SACRAMENTO, CAL.—Street-car transfers are to be good at any time during the day of their issuance if a measuse introduced in the Assembly by R. J. Callaghan of Alameda becomes a law. The bill provides that every transfer issued by a street railway company shall be honored by the conductor of the line for which the transfer is issued at any time during the same day that it is issued.

HOOD RIVER, ORE.—The principals of the electric road to connect Hood River with the North Bank road have been looking over the situation. The proposition roughly outlined is to run a track from Bingen to the Columbia River, crossing the river by ferry at the Koberg lock and then follow the county road into Hood River, connecting with the Hood River electric road, which is said to be a sure go in the spring.

WATER-WORKS.

REDMOND, ORE.—Redmond is to have a $10,000 water system.

CENTRALIA, WASH.—The City Council of Centralia plans to acquire a city water system to cost $200,000.

ASOTIN, WASH.—Engineer Foster of the Lewiston-Clarkston Company, is now engaged in surveying the town in order to make plans for the installation of a system of water-works.

OREGON CITY, ORE.—Willamette has sold $3600 worth of bonds to the First National Bank of this city. The sale insures an early beginning of the work of installing a complete water system.

SALINAS, CAL.—General Manager W. H. P. Hill of the Monterey Gas & Electric Company has applied for permission to string the 8-inch water pipe to take the place of the old mains in the water service, along Main street through this town.

RICHVALE, CAL.—Sealed bids will be received by the secretary of the Richvale Land Company up to 12 o'clock noon of February 6th, 1911, both for material used, in labor performed on and construction complete of the sewer system, septic tank, water system and cement walks for and in the townsite of Richvale.

ANAHEIM, CAL.—Six bids were received by the Council for laying a water pipe line on Broadway between Los Angeles and Walnut avenues. W. L. Kreuscher secured the contract for $589.67.

FRESNO, CAL.—The August Oil Company, operating in the Midway field in Kern County, will begin at once the laying of water pipe lines from their property to other portions of the field. At a meeting of the directors of the company held in this city, the work of laying a 4-inch water pipe line to a point 2½ miles northwest and to another point one mile east of the August property, was authorized. The August property is located on section 31. It is proposed to continue the line to the east, two miles south and east to the center of the Maricopa field.

SAN FRANCISCO, CAL.—According to an estimate made by G. A. Elliott, superintendent of maintenance for the Spring Valley Water Company, the recent storm has stored up in the company's reservoirs enough water to supply San Francisco for the next two years. Over 2,164,000,000 gallons of water has been added to the company's supply for future use in San Francisco. At Crystal Springs where the reservoir is ten miles long, the storm was most bounteous. The water in the reservoir, which daily supplies 5,000,000 gallons to the city, rose nearly two feet and increased the available supply of 1,624,000,000 gallons, making a total of available supply of 17,650,000,000 gallons. More than 400,000,000 gallons were poured into the San Andreas during the week. The total available supply of water in San Andreas reservoir was increased to 4,118,000,000 gallons during that period. Pilarcitos reservoir had an increase in the water supply during the week of 140,000,000 gallons, making the total available supply 326,000,000 gallons.

SAN FRANCISCO, CAL.—Affirming its decision of a year and a half ago in practically the same measures, the Supreme Court last week gave a victory to the city of Oakland over the Contra Costa Water Company, reversing the decision of the Alameda Superior Court and granting the city a new trial in the long legal battle over rates fixed by the City Council. In its original opinion the Supreme Court implied that the properties of the water company were not worth more than $3,500,000, and that a net return of 4½ per cent upon the investment was a fair and reasonable rate to allow a public service corporation. Last week the court undertook to explain that it did not mean to imply anything of the kind. With regard to the valuation of the properties the court said first, that the $7,000,000 figure set by the trial court was entirely unsupported by evidence, and second, "No value in excess of $3,000,000 being admitted by the pleadings, and there being evidence supporting a finding of value as low as $3,500,000, we were constrained to deal with the appeal, in the absence of a finding of value sufficiently supported by evidence on the theory that the value was no greater than the lowest amount as to which a finding would have been held to have been supported by the evidence contained in the record; that amount was practically declared to be $3,500,000." As to the rate, the court said: "We were not to be understood as intimating that such a return would be considered a fair and full return under all the circumstances were we a legislative body empowered to fix rates. But to be declared confiscatory the return must give less than the lowest reasonable percentage of profit upon the actual value of the property devoted to the public use." In other words, the court found that the rates as fixed by the city of Oakland could not be held confiscatory, even if they were not quite fair and reasonable. In its original opinion the court, referring to a net return to the stockholders of 4.68 per cent, said: "This certainly would be a very substantial net return, considerably more than is desired from many investments eagerly sought by capital."